PUBLIC WORKS.

CITY COUNTY STATE

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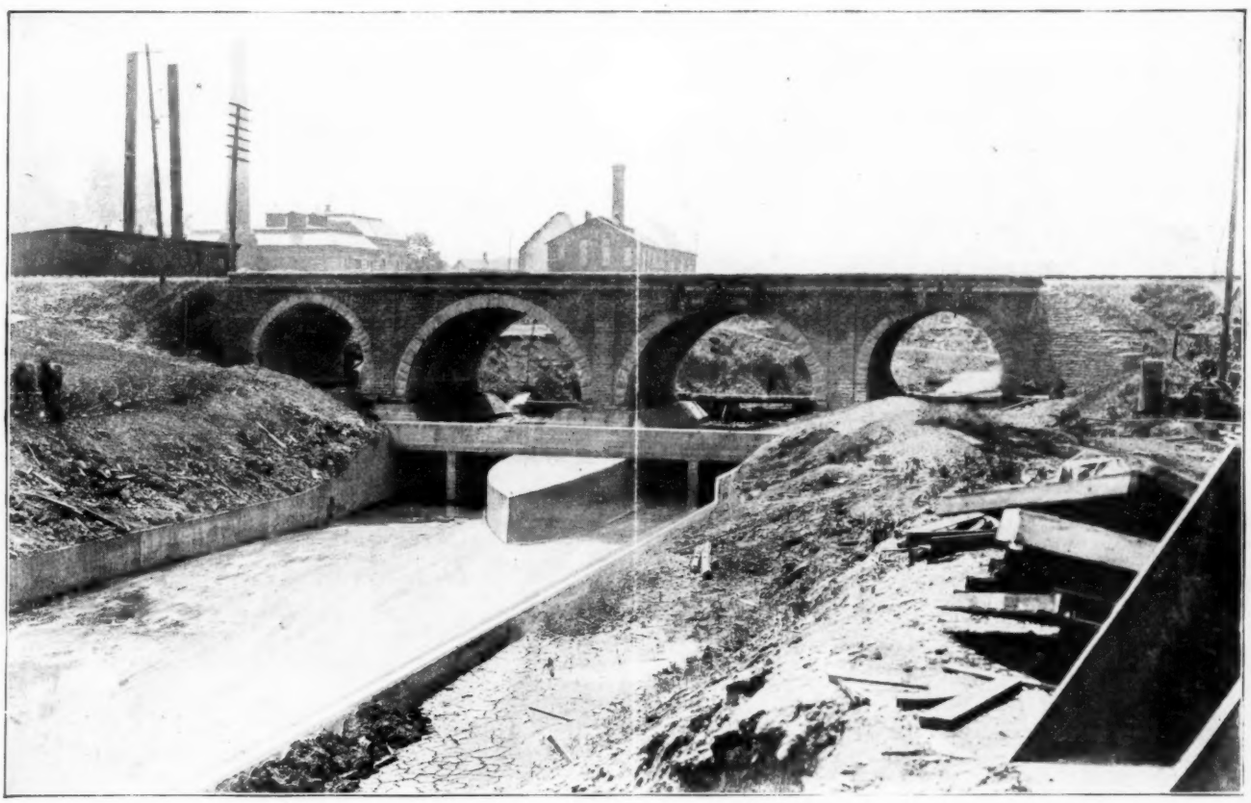

COMPLETED CONDUITS CARRYING TAIL RACE UNDER MAIN SPANS OF STONE ARCH RAILROAD BRIDGE BELOW ITS PIER FOOTINGS

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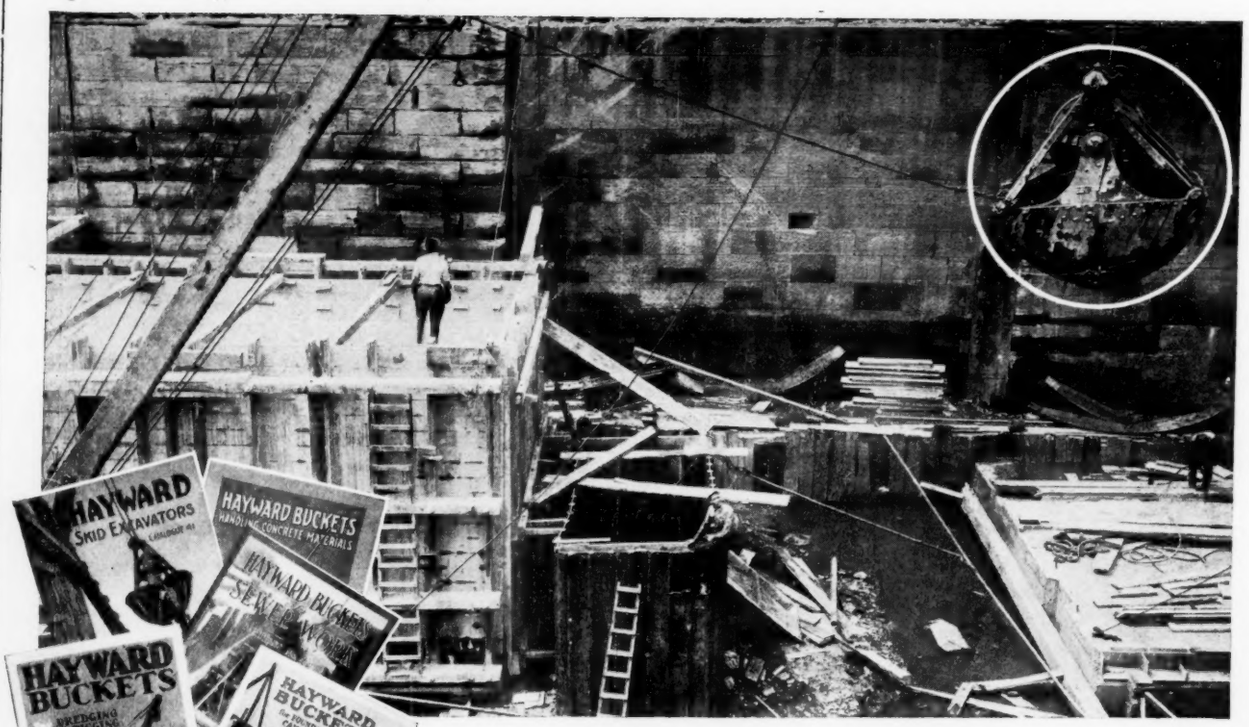
SEPTEMBER 4, 1920

Hayward Buckets



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PUBLIC WORKS.

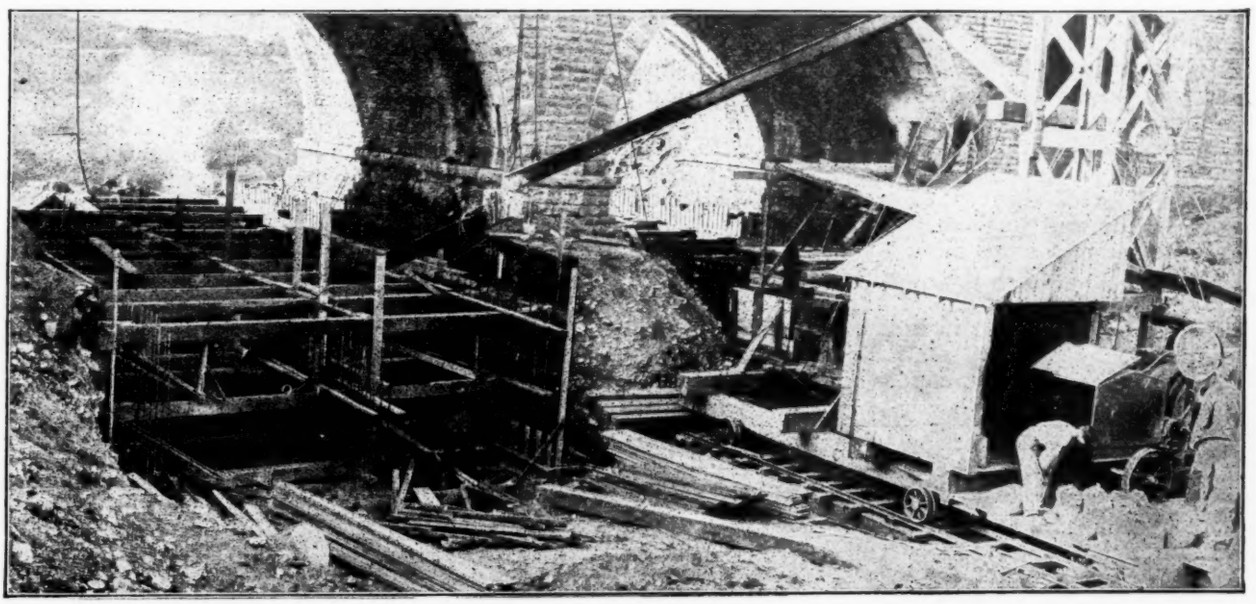
CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 49 FLORAL PARK, SEPTEMBER 4, 1920 No. 10

Excavating Below Arch Bridge Foundations

Concrete conduits 25 feet wide constructed on opposite sides of a railroad bridge pier and carried down 12 feet below the pier footings on gravel retained by steel sheet piles.



CONCRETING FLOORS AND SIDE WALLS OF TAIL-RACE CONDUITS UNDER TWO 30-FOOT BRIDGE SPANS

Among the operations involved by the improvement and flood protection work of the Miami Conservancy Commission was the construction of a tail-race for the Fordson tractor plant at Hamilton, Ohio. This conduit is an open channel with a normal cross-section 50 feet wide and a concrete floor and sidewalls. The floor is 6 inches thick and the sidewalls, 4½ feet high, taper from 3½ feet thick at the base to 1 foot thick at the top.

In order to pass under a four-span railroad arch bridge, the cross-section of the conduit was modified for a short distance to form two rectangular branches 20 feet wide and 8 feet high inside, each branch passing under one of two adjacent center arches of 30-foot spans. The bottoms of the conduits are about 12 feet below the bottoms of the old pier footings and the adjacent sidewalls of the conduits only about 6½ feet from the center line of the pier supporting the arches. These dimensions, necessitating excavations far below and very near the old footings on loose treacherous ground below water level, made the construction problem a difficult one.

The arches and spandrel walls of the bridge are of stone masonry in rather poor condition, with some cracks and settlement and with some voussoir stones fallen from the arch rings. The foundation of the center pier between these conduits was very shallow and had a timber grillage footing only about 10 feet wide resting on gravel and boulders 4 feet below the bottom of the river and 12 feet above the bottom of the conduit excavation.

To prevent undermining of the center pier and the two adjacent piers, a row of interlocking steel sheet piles less than 3 feet clear of the footings

was driven parallel to the conduits on both sides of each and extending beyond the upstream and downstream sides of the bridge, forming retaining walls for the trenches excavated between them for the conduits.

At the time of construction there was no water flowing under the bridge and the ground water, although having a natural level about 6 feet above the bottom of the excavation, was well drained by regular pumping in the supply wells of the Hamilton waterworks, so that there was only a moderate amount of seepage water in the excavation, which was removed by a centrifugal steam pump superseded by a Worthington duplex pump, both operated by steam obtained from the Baltimore & Ohio Railroad pumping station nearby.

All of the earth under the two main spans of the bridge, over each conduit, consisting chiefly of mud, gravel and boulders, was removed by hand excavation and wheelbarrows down to a depth of about 6 feet, slightly below the bottoms of the old pier grillages.

The hand work was supplemented by slip scrapers and when the excavation had reached a depth of about 8 feet below the original surface, lines of ranger timbers are laid parallel to the axis on both sides of each conduit, and the four rows of steel sheet piles were assembled and driven adjacent to them.

The rangers were braced and the excavation continued about 4 feet farther, another set of rangers and braces placed and a center trench dug in each conduit, in which there was laid a narrow-gage service track for steel side-dump cars into which the remainder of the material was shoveled and hauled out from under the bridge where it was dumped in a spoil bank, removed by a dragline excavator installed there for the construction of a protection levee close to the bridge. As the excavation progressed, a third set of rangers and transverse braces was placed in each trench, holding the sheeting so firmly that no displacement occurred and there was no undermining of the bridge piers or settlement of the old structure.

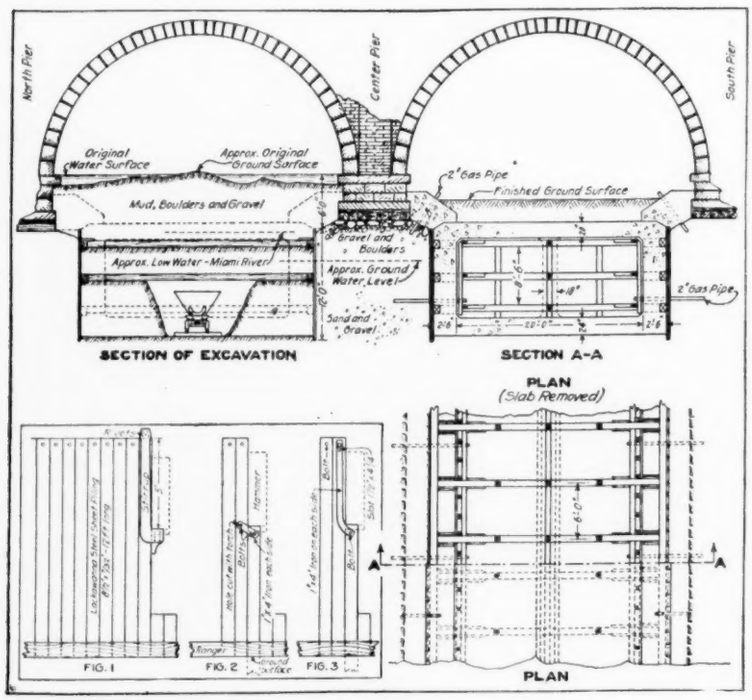
SHEET-PILE DRIVING

When the sheet piles were assembled for driving, there was only 12 feet of vertical clearance between the bottom of the excavation and the arch span overhead and, as the piles were 12 feet long, there was no room to operate the steam hammer in the usual manner. A special arrangement was, therefore, devised that permitted the hammer to be set below the pile top and was successfully developed for the satisfactory installation of the piles.

At first a riveted stirrup 5 feet long was made to hang on top of the pile and provide a shoulder on the face of the pile near its middle point to receive the hammer blow. This was subject to very severe vibration, proved inefficient, and was abandoned. Another stirrup, shown in Fig. 1, was designed with the hammer seat concentric with the forward edge of the pile and gave better results but broke in the angle at the foot. It was replaced with a heavier one of the same type, shown in Figure 1, with which the work was completed.

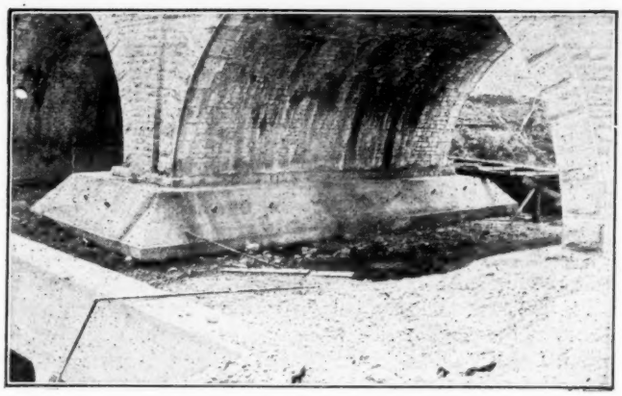
The operation of the hammer with the stirrup was so slow that attempts were made to drive the piles in 5 and 7-foot sections, spliced together and staggering joints. This idea was abandoned on account of the possibility of weakening the structure and impairing its water-tightness, and efforts were made to drive a 7-foot pile and insert a 12-foot pile in its place, but these were abandoned because the hole filled up with gravel before the long pile could be inserted. Another method tried was to drive one pile half way, attach a second one to it and drive the first one the remaining distance carrying the other one down with it and then attaching a third to the second, completing the driving of the second and so on. This was at first done by connecting the two piles with a short transverse link, shown in Figure 2, where the load on the connection bolts was so great as to shear through the pile web. The short link was finally replaced by the long one shown in Figure 3, which operated satisfactorily and was used for the remainder of the work.

After this plan had been perfected about 9 piles, as many as could be conveniently handled in one group



CONSTRUCTION OF TWIN CONDUITS UNDER ARCH SPANS

Details of Stirrup and Link Devices for Driving Steel Sheet Piles in Limited Headway



CONCRETE PROTECTION BETWEEN BRIDGE PIER AND CONDUIT ROOF

were assembled and interlocked in a horizontal position on the surface of the ground, revolved into a vertical plane, set against the ranger in the required position, and the first pile driven down 5 feet by means of the stirrup shown in figure 1.

The stirrup was then removed and the long link shown in figure 3 was attached to the first and second piles and the first pile driven down to the full length, carrying with it the second pile. The links were then shifted to connect the second and third piles, the driving of the second pile was completed, the links again shifted to third and fourth piles, the driving of the third pile completed and so on, until the piles were completely driven, after which another group of piles were assembled and driven adjacent to them in the same manner.

. The steam hammer was handled by a light wooden tripod traveler about 15 feet high, mounted on rollers. Its hammer was raised and lowered by a hand windlass mounted on the traveler platform with its hoist line over a sheave movable on the overhanging cap of the traveler, which enabled it to be so displaced transversely so as to seat the hammer on the pile top or alongside as required.

So many boulders were encountered that the driving was slow, 12 hours sometimes being required to drive a single pile, altho' on other occasions as many as 16 piles could be driven in one 10-hour shift.

CONCRETING

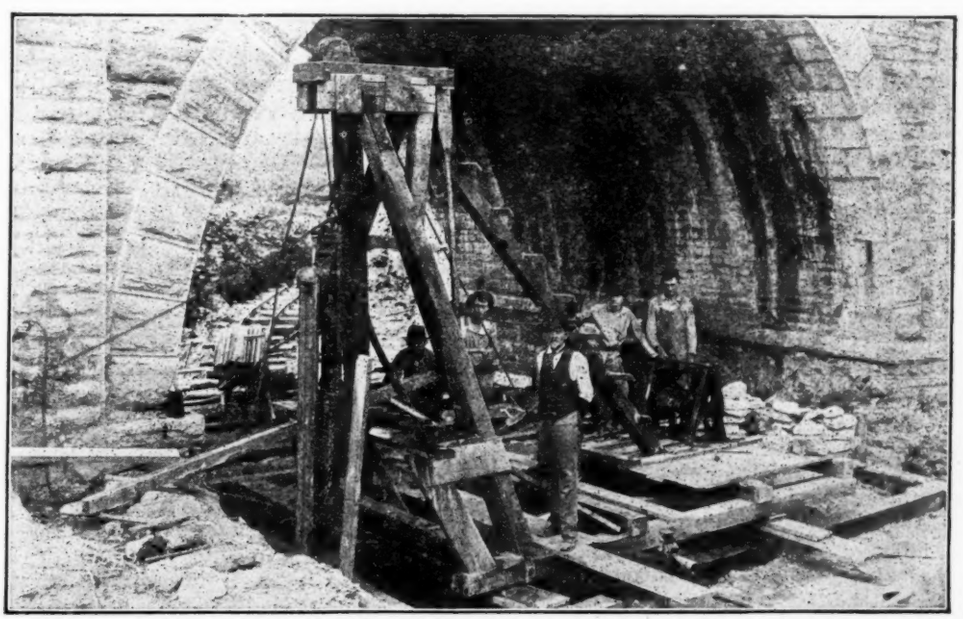
After the excavation had been completed the floor concrete (much thicker than that of the open conduit) was laid in sections 15 feet long and after it had set, wooden forms were built on it for the sidewalls and roof and were thoroughly braced inside with vertical and horizontal struts to resist the weight and pressure of the wet concrete.

The concrete plant consisted of a mixer and hoisting tower installed on a rolling platform that moved along the work to provide the concrete for the remainder of the tail-race. The concrete was spouted through a steel chute to the required position in the forms and completed each section of roof and sidewalls at one operation.

On the center line of the roof of each conduit, rectangular 6 x 12-inch holes were left open 12 feet apart on centers and after the concrete had hardened and the forms had been removed, new forms were built in the center of each conduit for a longitudinal supporting wall that was concreted through the holes previously left in order to give additional support to the roof for a future occasion when the latter will be required to carry an earth fill that may be deposited when the superstructure of the bridge is widened.

The roofs of the conduits serve as horizontal braces to resist any possible exterior lateral pressure against the sidewalls of the conduits and the steel sheeting, which is left permanently in position.

The spaces between the tops of the sidewalls and the arch piers were filled with continuous masses of concrete that were continued around the ends of the piers, really forming extensions to the pier footings, increasing their bearing area, and providing for the distribution of thrust between piers and conduits, as well as furnishing a



STEAM HAMMER DRIVING SHEET STEEL PILES AND HANDLED BY HAND WINDLASS ON TRAVELER

revetment and entirely inclosing the ground surface under the piers and thus protecting their foundations.

Numerous 2-inch gas pipes were cast in the revetment and in the lower part of the conduit walls which, after the conduits had set, were utilized for grouting which was executed under air pressure and continued until all of the air and water had been expelled and the grout flowed out of the upper tier of pipes.

This work, which was described in the Miami Conservancy Bulletin of July 3, was executed under the direction of the Miami Conservancy District, Arthur E. Morgan, chief engineer, and Chas. H. Paul, assistant engineer, and under the general supervision of J. H. Kimball.

Good Roads Committees in Ohio

The Ohio State Automobile Association is to organize a good roads committee in each county of the state, according to Charles C. Janes, secretary of that organization. The object is the promoting of an enlarged system of improved roads. There is already in Ohio the Ohio Good Roads Federation, but the State Automobile Association believes that it can give additional weight to the movement for good roads by the county organization proposed. It is proposed that the auto club or clubs in each county appoint a member for that county, and that the members from the various counties then get together for the purpose of working out a good roads program for the future.

Street Paving in Philadelphia

Nearly $8,000,000 of work being executed this year on 1,800 miles of streets and roads, League Island Park and Roosevelt Boulevard. Concrete delivered by auto truck service from central mixing plant.

The Bureau of Highways, Department of Public Works, of Philadelphia has charge of the construction, maintenance and repairs of about 1,800 miles of street, roads and pavements located in an area of 129 square miles, and exclusive of the roads in Fairmount Park which are in charge of the park authorities.

The annual budget of the bureau in normal years varies from about $5,000,000 to $7,000,000 but on account of war conditions that delayed non-essential construction, as well as the great difficulty in securing men and materials and the increased cost of labor and materials especially during the last two years, both new construction and repairs had been reduced to a minimum, increasing the large amount of urgent work that is now in progress.

The jobs under contract July 31st, numbered 213, these including 151 different contracts in active operation, 15 of which were of large proportion. For new paving the city will spend about $500,000, besides $5,000,000 worth that will be assessed directly on the property owners. The average cost amounts to about $60,000 per mile. About $1,000,000 will be expended for repairs to asphalt pavements, about $1,000,000 for repairs to other pavements, about $500,000 for grading, $200,000 for country road improvements, salaries and overhead. Besides the money raised by assessments, direct taxation, and that available from the city treasury, an additional fund of $1,500,000 has been provided by a special bond issue so as to be immediately available.

The street program embraces all of the roads in Philadelphia county, excepting those in Fairmount Park but including those in League Island Park and the Roosevelt Boulevard eight miles long which forms part of the Lincoln Highway

TYPES OF CONSTRUCTION

In the outskirts of the city, in some of the residential districts, and in suburban quarters where the traffic is light, there are about 300 miles of waterbound macadam with treated surface and bituminous concrete. The width of this road is usually from 14 to 18 feet with curbs 30 feet apart, except in the localities where the traffic is greater and the paved width is increased to 20 feet. The full width of this road is oil-treated annually and sometimes oftener, except in some cases where conditions are such that a single treatment may suffice for two years.

About 50 per cent of all paving is asphalt surface, which is used under many different conditions, for almost all kinds of traffic, and for grades of less than 5 per cent. About 15 per cent of the pavements are of brick which is usually laid in residential sections, on narrow streets, or on excessive grades up to a maximum of 15 per cent where "Hillside" (a grooved brick) is used to diminish slipping. About 2 per cent of the pavement is wood block, which is used in the center of the city and adjacent to churches, schools and hospitals.

All of these types of pavements are laid on concrete base. About 15 per cent of the total mileage is paved with waterbound macadam and bituminous concrete having a minimum width of 16 feet and an average width of 20 feet,

although in special cases the pavement often extends from curb to curb.

The balance of the paving in the city is of granite blocks, more than half of which are still supported on gravel foundations. It is planned to relay eight miles of granite this year, which in all cases is done with recut blocks. It is found that the old granite blocks, when removed from a given section of pavement and recut, will yield from 97 per cent to more than 100 per cent of the quantity required for the new paving. As the cutting is done rapidly, on the site, as the work progresses, it involves no delay and only a moderate cost, so that a saving of about $3 per square yard is effected without delay or trouble, and satisfactory pavement secured by its use.

ORGANIZATION AND CONSTRUCTION

The organization of the Highway Bureau includes chief of bureau, Fred C. Dunlap; principal assistant engineer in charge of construction, Chas F. Puff, Jr.; principal assistant engineer in charge of parkways and boulevards, Percy F. Proctor; division engineer in charge of bridge and sewer maintenance, J. C. McCormick, with a staff consisting of several clerks, engineer of permits and licenses, and six district engineers, each in charge of a separate district amounting to an average of about 300 miles of streets. Under these district engineers there are 25 assistant engineers and about 110 inspectors.

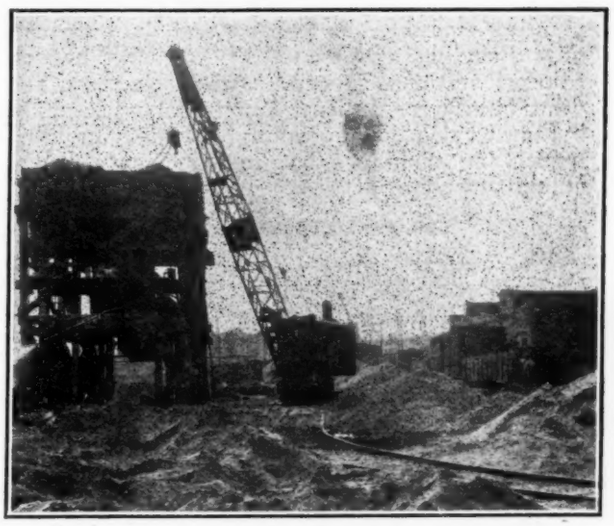
New paving, repaving, and important items of excavation or other construction are done exclusively by contract, but the city maintains a force of about 450 foremen and laborers for maintenance. This force operates from ten plant and supply yards conveniently located in different parts of the city, and at present is supplied with asphalt purchased ready mixed from a local company.

There is now under construction a $250,000 municipal asphalt plant which will be put in operation this fall with a capacity for 2,000 square yards of binder and surface course per day. At present asphalt repairs, both burning and cut-out, are made under contract ($1,000,000) supplemented by three municipal repair gangs of from ten to fifteen men each. The amount of work that is accomplished varies greatly with changing conditions, but may perhaps average 250 square yards per eight-hour day, with a maximum of about 400 yards per day.

ROOSEVELT BOULEVARD

The Roosevelt Boulevard, which forms an eight-mile section of the great national Lincoln Highway, is 300 feet wide with six rows of shade trees of many different varieties planted in the parking strips between the separate roadways. The center roadway, for pleasure traffic, is paved with asphalt 32 feet wide with a 2-foot gutter on each side. The two truck roads 34 feet wide have Topeka pavements with brick gutters on each side. In some cases the shoulders are of macadam temporarily provided to allow for future replacement with Filbertine or Topeka surface.

An important structure on Holme avenue, one



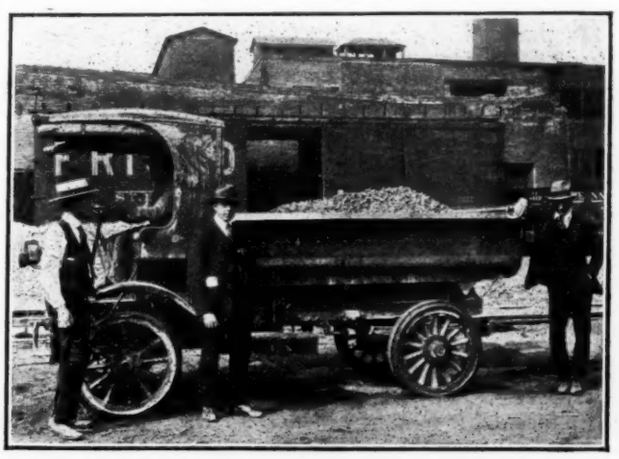
TRANSPORTING CONCRETE FROM CENTRAL MIXER PLANT TO DISTANT PAVING JOB

of the three branches of the Roosevelt Boulevard, is the bridge built on the site of the burial ground of Thos. Holme. It serves as a memorial to a pioneer Philadelphian who was notably loyal and efficient in the development of the city's street system. This bridge is of concrete arch construction, of massive and dignified design, relieved with pebble finish, and has one 90-foot highway span and one 40-foot span aver the railroad tracks, supported on concrete piers and abutments terminating with curved wing walls. The total cost of the bridge is about $200,000 and the cost of the boulevard to date is about $4,000,000, exclusive of land damages. It was commenced in 1903 and it is expected will be completed to Welsh road in 1920.

LEAGUE ISLAND PARK

The League Island Park, with an area of about 350 acres, is improved by grading, planting, lakes, drives, walks and buildings constructed by the Bureau of Highways.

The first contract for grading, seeding, roads, walks and five bridges was awarded in 1914 for the sum of $490,000. The second contract for



DELIVERING AGGREGATE TO CENTRAL MIXING PLANT

planting amounted to $40,000, and the bureau is now spending about $300,000 for boat houses, comfort stations, superintendent's quarters, and other buildings. In East League Island Park the bureau is also doing grading, planting, building walks and making other improvements to the amount of about $290,000.

CENTRAL CONCRETE PLANT

The central concrete plant installed by the Union Paving Co. and operated by it under the direction of the city with special supervision by Mr. Puff, was established in 1920 with a view to the elmination of possible difficulties and to its perfection to a degree that it was hoped would justify the subsequent establishment of one or more additional similar plants in other parts of the city, which it is now anticipated will soon be put in service.

It is located on the Schuylkill river and adjacent to the tracks of the Baltimore & Ohio main line, with connections to both the Pennsylvania and Philadelphia & Reading railroads, providing for delivery of materials by at least one transport line should the others be obstructed. It has a wharfage for six 500-yard scows that deliver sand, gravel, slag and broken stone, which are unloaded by a locomotive crane with clam shell bucket that deposits the materials in storage piles of about 6,000 yards capacity located on both sides of a standard gauge track running around three sides of the yard.

Asphalt sand is unloaded from scows by a stiff-leg derrick that also serves an elevated loading hopper which delivers to trucks below. Crushed slag also is received and handled like the broken stone and sand. Broken stone and cement are also delivered in railroad cars and the cement stored in a shed of 10,000 bags capacity.

The concrete plant is located in a 20 x 20-foot wooden tower 30 feet high, having in the upper part a 50-yard hopper-bottom storage bin divided into two portions. This bin is filled with sand and gravel or broken stone by the locomotive crane and discharges by gravity into the charging hopper of the Milwaukee mixing machine installed on the mixing floor about 16 feet above the surface of the roadway which passes under it through the tower. Cement bags are stored on the charging platform above the mixer and the two-bag batches of concrete, each containing 3 per cent of hydrated lime, are successively discharged into a loading hopper in the lower part of the tower which has a capacity for three batches, which together make a truck load that is delivered through a horizontal gate operated by a hand lever controlled by the driver of the automobile truck that hauls the concrete a maximum distance of five miles or more to the point where it is used.

This mixing plant is operated with a force consisting of one foreman, one engine-man, three laborers at the mixer, one yard-man, and one man in the cement house. The average production when working continuously is 1,500 square yards of base course in ten hours.

The concrete is mixed very dry so that a smooth surface can be secured by a hard blow with a shovel. After loading into the truck, which is previously sprayed with crude oil to prevent adhesion, it is well covered by a tarpaulin and is transported at an average speed, through ordinary traffic, of about twelve miles per hour, so that it reaches the point of disposal within thirty minutes after it is mixed.

The concrete is hauled in 2-ton trucks with elevating dump mechanism. From ten to twelve trucks are ordinarily kept in this service by the Union Paving Co., which operates this plant. A careful system of inspection records and time checks is maintained to insure the proper mixing of the concrete and prevent delay in its transportation. Very little trouble is experienced in delivering the concrete to the work within the required time and although the specifications are rigidly enforced it has very seldom been necessary to reject concrete because of poor quality or delayed deliverey.

Washington's Highways Laws

A thirty million dollar good roads bond issue, known officially as Referendum No. 1, presents to the state of Washington the possibility of placing its road building program on a modern business basis. Under the existing law the legislature appropriates money for work in the counties from which the money comes, which means a multiplicity of small jobs divided among the thirty-nine counties, each carrying its own overhead and resulting in increased cost. The proposed law would make it possible for the state to let the work in large units and more attractive to well organized contractors.

Sixty Million For Missouri Roads

Good roads advocates in Missouri are endeavoring to interest the citizens in good roads to the point of issuing $60,000,000 in bonds for that purpose. It is reported that there is no organized effort to defeat the bond issue, the only argument against it being that more than $20,000,000 was voted last year by the various counties and road districts for this purpose but no improvement in the highways seems to have resulted; which is answered by reference to the difficulties that all states have found in getting road work done this year.

Road Material Transportation Improving

Thomas H. McDonald, chief of the U. S. Bureau of Public Roads, announces that assistance is being rendered by that bureau in handling requests to the American Railroad Association for cars to be used for transportation of materials for road maintenance and construction work. He specifies the steps necessary for securing cars and states that the Interstate Commerce Commission desires co-operation between shippers and local railroad officials to settle transportation problems without action from Washington. Returning coal cars are now being routed so as to utilize them for handling road materials without interfering with priority for coal service.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Erecting 30 - foot Bridge Girders Without a Derrick

THE PROBLEM

A roadbuilding contract consists almost entirely of light grading, draining and concrete pavement for which the contractor has proper equipment. But the road crosses over a railroad and highways that are to be spanned by two plate girders 30 feet long and 24 inches deep that weigh about 5,000 pounds each and are to be set 16 or 18 feet above the railroad track or highway below which must not be obstructed. The girders will be delivered at grade at the abutment by motor trucks.

The contractor wishes to erect them himself to save the heavy expense of sub-contracting to a steel erector. He has no plant except ordinary roadbuilding equipment, and cannot easily rent a derrick, tackles, or other special apparatus for handling these heavy girders. Is there any way by which he can economically put them in position without buying or renting heavy or expensive apparatus?

THE ANSWER

There are several ways in which these girders can readily be put in position on the abutments. Probably the easiest is by the protrusion method with rollers and a pilot beam, where the girders are simply pushed across from one side to the other, requiring only three or four rollers, a couple of long and heavy planks, a few bolts and a level space 40 feet long adjacent to one abutment.

In the line of the permanent position of one of the girders, on the level space at the abutment where the girders are delivered, set two fixed or "jack" rollers A and B, 14 feet and 24 feet respectively from the face of the abutment, and place one of the girders on them with the web vertical and the lower flange bearing on the rollers as shown in the diagram. The rear end of the girder should be supported by any convenient roller C.

Take two 12-inch pilot timbers or planks 20 feet or more long and 3 inches or more in thickness, place one on each side of the girder web, overlapping it 3½ feet or more, and projecting 16½ feet beyond in a horizontal position. Bore ¾-inch holes through these timbers 2 feet apart on the center line, one of them 6 inches from the forward end, and another hole close to the end of the plate girder. Drive a ¾-inch bolt through each hole, put a large washer on each end of each bolt, and screw the nuts up as tightly as possible without stripping the threads.

Have the lower edges of the pilot timbers in perfect contact with the upper side of the bottom flange of the girder, and fill in all the space between the top edges of the timbers and the top flange of the girder and next the web, with solid wood packing very tightly wedged in place and having perfect bearing throughout. Have the packing 3½ feet in length and clamp it and the ends of the pilot timbers to the girders by three yokes each made of two 6 x 8-inch or larger vertical pieces 3 feet long with two ¾-inch bolts through each end. These clamps must be fitted accurately to good bearing throughout on the timber and packing and must clear the girder flanges. The bolts must be screwed up as tight as possible on washers at each end.

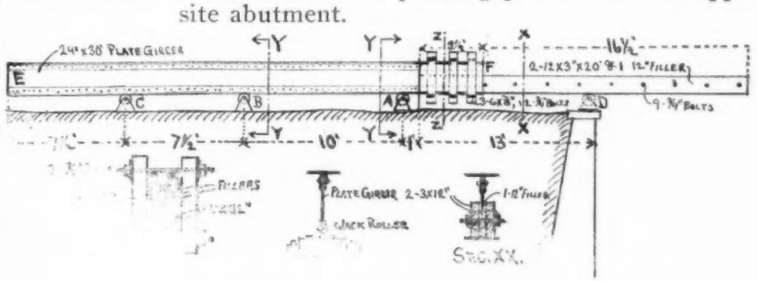
The two bolts at the forward end of the pilot timbers should have a nut at each end, and no heads, and should project 6 inches beyond the nuts at each end. A strong Manila hauling line should be attached to them, led to the opposite abutment and well snubbed around a tree or some other secure anchorage.

When all is in readiness, the girder should be launched forward on its rollers for a distance of about 13½ feet when roller B should be shifted to position D.

Roller C should be temporarily removed and a little pig-iron, stones, sand or other heavy ballast firmly secured to the end of the rear end of the girder at E if necessary in order to make it over-balance the forward end around the roller B as a pivot.

The roller C should be replaced and the girder pushed or pulled forward about 13½ feet, care being taken to pull in the hauling line slack and hold it securely as the girder advances.

Roller B should then be removed and placed in new position D on the abutment and roller C shifted to a corresponding position on the opposite abutment.



GIRDER WITH PILOT BEAM EXTENSION, ON ROLLERS, READY TO LAUNCH

The girder is then advanced until the front end of the pilot beam takes bearing on the roller C on the farther abutment, great care being taken to keep the hauling line taut and the slack snubbed securely until this bearing is accomplished.

Continue moving the girder forward until it is in exactly the required position, then bear down on the forward extremity of the pilot beam and lift up with a lever on the rear end E of the girder, thus releasing the roller D. Lower the girder to final bearing on its seat at D then with a lever, lift the forward end of the pilot beam, remove roller C and lower the girder to position on abutment there, remove the pilot beam, clamps and rollers, and repeat the operation for the other girder. The rollers, pilot beam, bolts and rope will be uninjured and ready for any other service. If plugs are driven tightly through the bolt holes in the pilot timbers, the strength of the latter will be scarcely impaired.

An Extensive County Road Building Equipment

In Crittenden County, Arkansas, the road projects totalling about $3,000,000 and including 50 miles of concrete and 115 miles of gravel roads are being built for four districts that have invested about $5,000,000 in railroad and construction equipment which includes one item of one hundred and five 80,000-pounds open top automatic steel dump cars purchased from the Western Wheel Scraper Company for about $300,000. Gravel pits have been opened in Missouri and Arkansas, each of which are expected to furnish daily a solid trainload of gravel cars that will be run to full-length sidings at five different places where the gravel will be unloaded by some of the ten locomotive cranes that will place it in storage piles, and reclaim it for the 40 motor trucks that will distribute it on the work.

Wilmington's Municipal Paving Plant

Wilmington, Delaware, has joined the considerable number of cities which operate municipal paving plants, having now under construction such a plant on Brandywine Creek, on the outskirts of that city. The plant was designed by Alfred S. Hirzel, engineer in charge of constructing of the Street and Sewer Department. The property has a frontage of 20 feet on the creek, 220 feet at the rear and is 366 feet dep. A dock is being built along the creek at which sand, stone and gravel can be unloaded from barges. Also, a switch from the line of the Pennsylvania railroad runs to the plant. The building for housing the asphalt plant has been completed and it is proposed to erect storehouses, equipment houses, two 10,000 gallon tanks for holding asphalt and oil, and an office building. The asphalt mixing plant has been installed by Warren Brothers and is supplying the asphalt material used by the city, but the asphalt is purchased in barrels rather than tank cars, as the storage tanks have not yet been constructed. The mixture now being used is 850 pounds of cement, 105 pounds of asphalt and 50 pounds of limestone dust. The remaining portion of the plant, especially the building of the dock wall and filling in behind it, will be done from time to time as the regular employees of the street department can be spared for this purpose.

Philadelphia and Bonding Company Disagree

A few weeks ago the director of public works of Philadelphia announced that he would refuse to approve contracts, the bonds submitted in connection with which were those of a certain surety company, until that company had adjusted satisfactorily to the city a contract of over $1,000,000 for a sewage disposal plant. This contract had been abandoned by the contractor, who had been bonded by the surety company in question for more than $500,000. Temporarily at least this necessitates contractors obtaining bondsmen other than the one with which the city is having this disagreement, and it is stated that a number of contractors who have recently received awards from the department have been required to change their bondsmen.

Ohio Gives Priority To Road Materials

On August 18, the State Utilities Commission of Ohio ordered all railroads in that state to give priority to road-making materials and supplies and to immediately assign cars for filling orders for such materials. This action was taken at the request of the State Highway Department, which declared that the construction of new roads and maintenance of old had been but 50 per cent of what was needed because of the failure to secure transportation of materials. Highway commissioner Taylor is reported to have estimated that the state would have spent more than $1,000,000 on roads by the middle of August had the materials and the machinery been available.

Serious Accident To Water Works Men

Five men prominent in various departments of the water works field met with an accident on August 19, when the steering gear of a touring car in which they were riding broke when they were near Selkirk, Ontario.

Arthur P. O'Leary chief of the Bureau of Records of Rochester, N. Y., was killed, and Leon S. Barnard of Buffalo, manager of the Hersey Manufacturing Co. and a member of the Buffalo Chamber of Commerce, was seriously injured and died a few days later in the hospital in Dunnville, Ontario. C. R. Wood, of the R. D. Wood Company of Philadelphia, was seriously injured also. G. C. Andrews, commissioner of the Bureau of Water of Buffalo, and B. G. Little, superintendent of water works of Rochester, were in the car but were uninjured.

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Everyday Construction Problems

In this issue, PUBLIC WORKS opens a department for furnishing practical information about construction work, explaining both special and ordinary operations and facilities, and suggesting suitable methods and plans to contractors who may encounter something out of their ordinary field or who may not be familiar with some particulars of usual practice or latest developments.

No matter how experienced or well-informed he is, it is impossible for any contractor to know all about all kinds of construction. He may be very competent and well posted in one or in several general kinds of work, but even in them there will be some things that he is not familiar with; and outside of these lines there will be many, the special features or even ordinary practice of which he has had no occasion to investigate.

The contractor with large resources and a technical organization can analyze, experiment and design for himself in such cases if time and opportunity afford. An inexperienced contractor, one with limited resources, in an isolated locality, or who is suddenly confronted with some problem quite different from his ordinary routine, may not be able to find the solution readily or may adopt an unsatisfactory one that may cost him unnecessary time and money. He would often be greatly assisted by prompt and reliable information concerning safe, simple, and economical methods of doing work with which he is unfamiliar, although many of them may be well established. It implies no discredit to any contractor to be unfamiliar with work outside of his usual sphere even if it is commonplace to those who specialize in it.

In this country competition has subdivided construction so much that specialists have been developed in almost every field; large varieties of plant and equipment have been provided; and all kinds of services and most types of construction, together with methods and operations of execution, have been more or less standardized. Ordinary questions relating to the execution of the work and even to its design and financing can, therefore, readily be answered in a general way by experts so as to give information suited to the problem or easily modified to cover it. Sometimes apparently simple questions involve considerations and other questions that appear difficult to the inexperienced have solutions that are obvious to those that have previously encountered them.

Although the editors of PUBLIC WORKS have not recently been in charge of actual construction and are not qualified as contractors or superintendents, it has been their privilege for many years to occupy the field of important and widely diversified construction, and to maintain confidential relations with many engineers and contractors and thus have up-to-date familiarity with the difficulties and requirements of many kinds of work and with the methods, plants and operations involved. They also have access to

great technical libraries and opportunities for conference with specialists and experienced contractors in almost every field, enabling them to prepare or secure reliable conservative replies to most questions likely to be asked. These questions are cordially invited in order that we may benefit contractors; and on the other hand, notes, memorandums and photographs of separate features, no matter how subordinate, of difficult or interesting work are solicited from the same sources.

There is no limit to the field of inquiries we invite in this department so long as they are genuine and are accompanied by sufficient data of conditions and requirements. A few of the subjects that may perplex contractors that have not previously had experience with them are indicated by such questions as these:

What is a good system for loading, unloading, storing and handling aggregate for the large concrete job described herewith?

What is the best way to secure water and broken stone for this concrete road job?

How place concrete under water?

How best handle and erect a small quantity of heavy steel work?

How use oxy-acetylene flame for this wrecking or repair work?

How handle earth excavation in a deep trench?

How handle quicksand in excavation of the nature described?

How drive sheet piles and pull them for deep sewer trench?

How drive foundation piles in small headroom?

How apply given formulas?

How to build cofferdam on rock bottom?

How unload and transport very heavy units without special facilities?

The answers to such questions will indicate a rational application of standard practice and simple resources to the special conditions involved, such as can be properly undertaken by competent mechanics and superintendents, without solving problems whose importance or difficulty require the services of a consulting engineer or expert.

Unlimited Water For Dallas

The editor of one of the daily papers of Dallas, Texas, has recently given prominent expression to an opinion which is not as prevalent as it used to be but apparently still obtains in some quarters. This is that people should not be asked to economize in the use of water, but that it is very desirable to permit them to use all they want without any restraint such as meter rates or other pro rata charges.

The editorial in question says: "We should, instead of having need or occasion to urge the practice of economy in the use of water, encourage the use of it in quantities which, by test of the present per capita consumption, would be thought extravagantly large. Only so can Dallas become the city of great beauty that all of us should be ambitious to have it be. We should make water so cheap that few citizens would be under inducement to be sparing in the use of it. But this can be done, of course, only by making the supply superabundant. It might be necessary, as a means of bringing about that large use of water, to incur a financial deficit in the water department. That would sin against the supposed virtue of making the water department pay its way. But that, in our view, is only a spurius virtue."

Of course, if the people with open eyes decide to provide a superabundant supply with full knowledge of the great increase in taxes or water rates or both which it will cost them, there can be no objection to their doing so unless such extravagent use of water deprives other municipalities of water which they are in real need of. It is not often, however, that the taxpayers of a city the size of Dallas are willing to spend one million, two million or five million dollars for the privilege of having all the water they can possibly waste as well as use.

Municipal Bonds In July

The total sales of municipal bonds in July are reported by the *Daily Bond Buyer* to have been $50,717,202, which is slightly less than the sales for June, and only about two-thirds of the sales for July, 1919. However, the sale of municipal bonds for the first seven months of 1920, $412,324,045, considerably exceeded the sales for the corresponding period of 1919, which were $387,537,802.

The serious falling off in the sale of municipal bonds during the last few months has been caused by a slump in the bond market. During this period hundreds of issues have been found unmarketable. The largest cities of the country are now compelled to issue 5½ per cent or 6 per cent bonds to meet the market rates on loans and many municipalities either have been unwilling to pay such a rate or have not been permitted by law to do so. Had the bond market been as favorable as it was last year, the sale of municipal and state bonds this year would in all probability have reached the billion dollar mark. The largest individual loans during July included $4,000,000 by the state of Pennsylvania, $2,475,000 by Dallas, Texas, $1,170,000 by Columbus, $1,165,000 by San Francisco, and $750,000 by Cleveland Heights.

Decatur's Temporary Dam

The city of Decatur a few days ago completed a temporary dam which cost about $40,000 and which will store a supply of water probably sufficient to relieve the present shortage. A permanent dam is to be constructed which will raise the water more than 7 feet higher and thus greatly increase the amount of storage. When the permanent dam has been completed it is contemplated that the one just finished will be removed, although it would probably last a generation if necessary.

Water Filtration Experiments and Devices

In studying the purification of Lake Michigan water, Mr. Ellms experimented with mixing channels, fish ladder, "flume" and "fall," and concluded that coagulation could be effected more cheaply and just as effectively by one of the smaller devices as by a large coagulation basin. The devices and results are described below.

In connection with the experiments conducted by Jos. W. Ellms for the commissioner of public works of Milwaukee upon the best method of treating the water of Lake Michigan in order to make it more suitable for consumption (a general description of which was published in the August 21 and 28 issues of PUBLIC WORKS), a number of devices and methods were tried out, chiefly in connection with the mixing of the chemicals with the water and sedimentation preliminary to filtration. From the report of the experiments, which extended over practically a year, we have abstracted the following descriptions of the more interesting and important of the experimental features.

COAGULATION

Four new devices were tried for securing coagulation, as described in the previous issues named above. These devices were given the names of "fall," flume, fish ladder, and mixing channels. The poorest mixing action was obtained with the "fall." Somewhat better results were obtained with the fish ladder. With the "flume" an excellent mixing action was produced at a comparatively low velocity of flow, but the loss of head was considered too great. By cutting the flume into two parts and attaching the box known as the "fall," the loss of head was cut down about 25 per cent and good results were obtained.

Finally by removing the weirs from the flume, extending it slightly into the receiving box or "fall," and placing a low weir at the end, a hydraulic jump was produced by the rapid flow of water down the flume. The impact of water flowing down the flume into the pool back of the weir produced a turbulent condition of the water which effectively mixed the chemical solutions and the water. Considerable air is trapped in the jump and its escape contributes materially to the turbulent condition of the water and consequently improves the mixing action.

"The results with this device have been very satisfactory, and the reason for it requires explanation. When a precipitate is the product of a chemical reaction, it first appears in a very finely divided condition. In the case of a colloidal precipitate such as ferric hydroxide or aluminum hydroxide (the two compounds utilized in water purification), the aggregation of these particles into larger masses is necessary, not only to entrap the fine sediment and minute bacteria in the water, but to prevent them from passing through the sand bed of the filters. It is obvious that violent and continued agitation of the water will hinder rather than assist in this clotting together of these particles, and hence, to aid this coagulation, a quiescent condition is necessary.

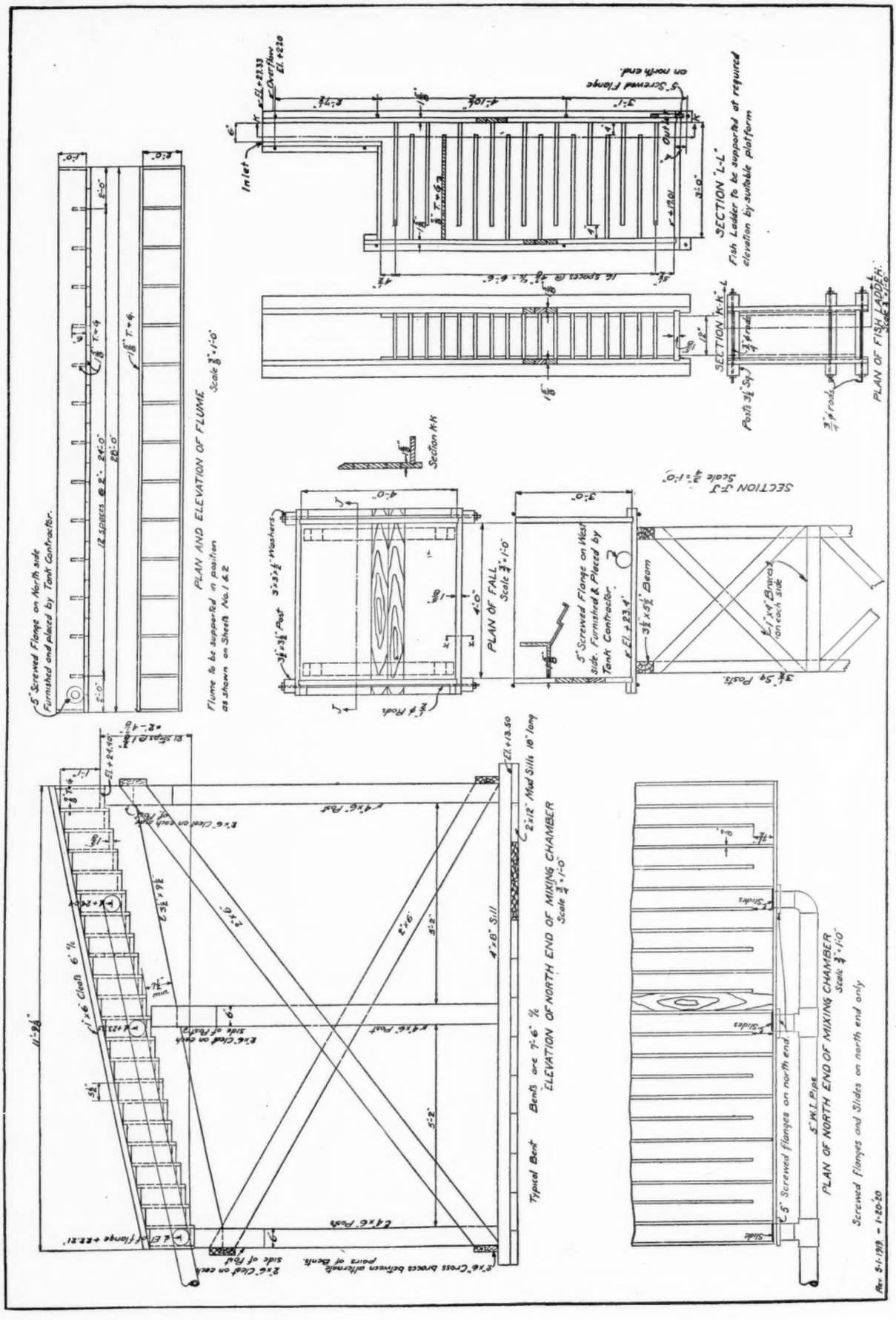
"The hydraulic jump mixing device provides an extremely rapid and thorough mechanical mixing of the chemical solution and the water to be treated, thereby bringing the reacting substances together and hastening the reaction. Immediately following the jump, the water flows quietly to a settling basin in which the physical action of coagulation can take place with the least possible amount of agitation, and thereby reduces to a minimum the breaking up of the floc during its formation."

In addition to these devices, experiments were made with the mixing chamber. It was found that prompt coagulation took place in the first five or six channels, but that the size of the floc decreased as the water passed through the remaining channels. In order to see whether reduction in size of the flocculated particles was due merely to flow through the straight channels or was caused by the agitation of the water as it passed around the ends of the baffles, the channels were blocked about 18.9 feet from the end and new openings cut through the baffle walls, thus giving the same number of reversals of flow but cutting down the length of each channel from 60 feet to 18.9 feet. Although nearly 70 per cent of the length of the chamber was thus cut out of service, the results were as satisfactory as before, but not more so.

SEDIMENTATION

The settling tank was 40 feet long, and 18 feet 6 inches wide and 9 feet deep. It was divided into four equal sections or passageways by three baffle walls. There was an influent flume at one end and an effluent flume at the other. In the last passage a third flume connected the influent and effluent flumes. The length of travel of the water along the center line of the passageways was about 175 feet. By use of weir planks and stop planks it was possible to use one or more of the passageways and thereby obtain different periods of sedimentation.

The theoretical displacement period, with a rate of flow of 125,000 gallons per day, was 7.5 hours and the lineal velocity 0.33 foot per minute. Float observations were made to determine actual lineal velocities and an average of six of these



DETAILS OF MIXING DEVICES, MILWAUKEE EXPERIMENTAL FILTRATION PLANT

gave 0.56 foot per minute, or about 70 per cent greater than the theoretical velocity. "While this result was not entirely unexpected on account of previous experience, still it was rather surprising in view of the shallow depth of the tank (8 or 9 feet) and the manner in which it was baffled. Evidently the surface water slides over the more slowly moving or even almost stagnant water near the bottom, and thus passes through the tank in a much shorter time than called for by complete displacement."

Even with average turbidities of only fifteen to twenty parts per million in the raw water, this tank gave a reduction of 67 per cent for a theoretical displacement period of 7.5 hours when using alum as a coagulant. The micro-organisms removed varied from 61.1 per cent to 84.6 per cent, reducing the average number from 596 in the lake water to 128 in the settling basin.

It has been found in several cases that increased turbidity aids coagulation, and on account of the small amount of natural sediment in the lake water and its low temperature it was thought possible that the coagulation of it might be improved in this way. An aluminous clay was obtained which readily disintegrated in water and this was applied to the lake water as it entered the mixing device, at which point also the coagulating chemical was applied. In this way the turbidity was increased from three parts per million to twenty-one. The results obtained were rather unsatisfactory. A larger floc was produced but there did not appear to be any improvement in the effluent from the filters. On the other hand, the filter sand was overloaded with clay, and this was not removed by washing, the effluents of the filters being slightly turbid at the beginning of a run or just after washing them.

Sulphate of alumina was used as a coagulant in thirty-two operation periods, and sulphate of iron with lime was used in thirteen. Good results could be obtained with either. Different amounts of each were tested out and in general it appeared that sixteen to twenty parts per million of either coagulant would be required to produce good results.

FILTRATION

Two filters were used in the investigation, one equipped with a common type of strainer system, namely, a perforated pipe manifold laid on the bottom of the tank. The other filter had a wooden grid strainer system consisting of 1 in. by 6 in. boards set on edge and spaced 1 inch apart. The under side of the grid was placed 6.5 in. above the bottom of the tank proper, thus providing a space under the strainer grid which was filled with filtered water. The peculiar features of this latter type of strainer consisted in the opening to the filter bed totaling practically 50 per cent of the area of the bed, while the opening in the perforated manifold totalled only 0.3 per cent of the area of the bed. Otherwise the two filters were constructed alike.

The wooden grid strainer gave good results, but it is believed that had there been available a wash water pressure capable of producing an upward velocity of 2 to 2.5 ft. per minute, the bed might have been "blown up," allowing the sand to work its way down through the gravel into the bottom of the filter below the grid. If high velocities through the gravel can be properly controlled by a sufficient depth and grading of the gravel, it is believed that this grid will furnish a comparatively cheap, simple and effective type of strainer. Further experiments for the purpose of establishing the correctness of this opinion would be necessary before this strainer system could be adopted safely for a large plant.

A portion of the sand for the filter was obtained from Red Wing, Minnesota, and the rest was local sand from the lake shore. The lake sand first employed was coarsened by washing in a specially designed washer. Later on the sand was selected so as to obtain as coarse material as possible and then was washed in the filter tank. This washing brought several inches of fine sand to the upper layers, where they were removed after each washing down to the point where the sand of the effective size desired was found.

It was thought probable that for the large municipal plant, lake sand could be used and washed in this way so as to obtain a size suitable for the filters. Laboratory investigations were made along these lines, and these indicated that a complete stratification or arrangement by sizes was effected by this method of washing, and that the most effective portion of the sand, the finest, was carried automatically to the point in the filter bed where it would do the most effective work. A bed so arranged by stratification also offers the least resistance to the flow of water through it during filtration.

The experimental filters were found to operate with much shorter periods of service between washings than is found possible in many plants because of minute plants in the water which formed a gelatinous mat over the surface of the sand, and accumulated so rapidly on account of the number present in the water that they greatly retarded the passage of the water through the bed. Working at the rate of 125 million gallons per acre per day, the average length of service of filter A was only 10.49 hours and that of filter B was 6.05 hours. The longest run of either filter was 20.27 hours and the shortest run was 4.55 hours. Microscopic examination of the water indicated that there were never less than 100 to 125 of these organisms in each cubic centimeter of water, and as they averaged .02 m.m. in diameter, in four hours there would be applied enough to form a continuous surface coating of these diatoms over the entire surface of the sand bed. These short service periods considerably reduced the efficiency of the plant. This condition was relieved by a practice known as "breaking the filters." This consists in closing the effluent valve of the filter and opening for about half a minute the wash water valve. The rising wash water breaks the surface of the sand bed, throwing the deposited matter into suspension or displacing it so that a fresh surface of sand is exposed through which the water may filter. After the wash water valve has been closed, the

effluent valve is again opened and filtration resumed.

The breaking of a filter may usually be done to advantage twice between washing. Periods of service are lengthened from 200 to 300 per cent and the wash water percentages are proportionately diminished, since no wash water is really lost by the breaking process, although such as is used must be refiltered and repumped. Tables giving data collected during the tests show that a gain of 10 to 15 hours in the length of run and a reduction of 2.5 to 3 per cent in the wash water was effected by breaking.

As to the effect of breaking upon the quality of the water, the lower the rate of filtration, the finer the sand, the less the disturbance of the sand bed when broken, and the better the coagulation, the less will be the deterioration in the quality of the filtered water. But it is obvious that unless a sufficient disturbance of the bed is effected so as to reduce the friction head of the flow of water, it fails of its object entirely; hence the operator usually endeavors to produce only such a loosening of the filter bed as will re-establish the rate of flow with the least injury to the quality of the effluent.

Different periods of rest were tested and it was concluded that a rest period of several hours should intervene between the washing of the filter and starting it again, whenever this was possible. The practice of wasting the effluent from a filter for a short time after starting is now rarely employed but the common practice nowadays is to disinfect the filtered water continuously and thereby obviate the necessity for wasting any filtered water.

Rates of filtration were tried up to 175 million gallons per acre per day. While operation at the higher rates seems to have had little effect upon the number of bacteria in the effluent, the effect of insufficient amounts of chemical coagulant, especially quantities below 10 parts per million, was quite noticeable.

Protecting Purity of St. Louis' Water Supply

The water works of St. Louis has been reported upon quite favorably from the point of view of affording protection, as described in our issue of August 14, but, in spite of the purification plant which is perhaps as up-to-date in construction and as well managed as any in the country, there is room for improvement in the character of the water delivered from the point of view of purity. For the water after purification is delivered into open reservoirs and, as is quite common under such conditions, receives impurities from the air. One of them at least is so located as to receive more or less impurity of a possibly dangerous nature which is blown from a bridge nearby at a higher elevation. Commissioner Wall has annually for five years past recommended that these reservoirs be covered, but so far has been unable to obtain favorable action by the Board of Aldermen.

It certainly is difficult to understand why the aldermen should refuse for years to protect the purity of the water supply on which the health and safety of their citizens depend and to secure which they have expended for a filtration plant many times the cost of covering the reservoirs. In fact, the running expense of the filtration plant for one year would probably cover the cost of this protection.

New Orleans Water Works and Drainage Capacity Exceeded

New Orleans has for several years been approaching and now is actually facing a serious condition in connection with its water supply and its drainage, and the superintendent of the Sewerage and Water Board, George Earl, in his latest annual report which has just been issued, calls attention to the seriousness of the situation, as he has done in several previous reports.

At present water is brought to the pumping plant through a single 48-inch pipe and the capacity of this is frequently reached by the present service. A double main should be installed, both to increase capacity and as a precaution against accident. There is practically no water storage in the city, and any interruption of service in suction pipe, pumping plant or delivery system would be a very serious matter. Owing to the insufficient capacity, the pressure in the lower or central portion of the city would be greatly reduced in the case of a large fire.

Not only the quantity but also the quality of the supply is threatened. The nominal capacity of the purification plant is 40 million gallons daily. For five months in 1919 this plant purified this amount as an *average* for the entire season and was compelled to greatly exceed this rate for many days at a time, occasionally carrying loads for hours at a time at rates of over 60 million gallons a day. This, of course, means that the overworking of the plant threatens a lower efficiency of purification and that it should at once be increased 50 per cent in capacity.

New Orleans, being below the level of the Mississippi when it is in flood, can prevent the flooding of its streets only by the operation of its drainage canals and pumping plants. It has now 12,000 horsepower available for pumping, but during storms of considerable magnitude all of this power is not sufficient to operate all of the drainage pumps or remove the accumulating drainage flow rapidly enough. If one of the drainage pumps should ever break down during heavy rainfall it would be utterly impossible to prevent the flooding of the lower areas of the city, or to remove the flood water within a reasonable period.

In addition to this, there has not been sufficient funds for several years past to construct sewers and water mains as rapidly as the growth of the city demanded and there are now at least 50 miles of streets in which such mains should be laid. At present there is being served by the Water and Sewerage Board about 600 miles of streets and 410,000 population. It is estimated

that by 1940 the service should be extended to 1,200 miles of streets, and this would require an average expenditure of at least $2,500,000 a year from now until 1940 in continuous extension and improvement work. The Sewerage and Water Board has never had over $450,000 a year for such development and it is, therefore, imperative that a change in policy be made at once, or else the city must cease to grow except by the addition of such character of improvements as will be content to exist without water supply, sewerage or drainage.

Designing Aqueduct of Winnipeg Water Works

By James H. Fuertes

In previous issues of PUBLIC WORKS we have given analysis of the conditions affecting the general design of the new water works of Winnipeg, Manitoba, and a description of the works designed to meet these conditions; this being part of a paper prepared by Mr. Fuertes for the American Water Works Association. In the same paper he described the process followed in designing the several aqueduct sections, which part of the paper (like the other, unusually thorough and informative) is given below.

ARCH DESIGNS

The design of the aqueduct sections was influenced by many considerations, among which the most important were:

1. Solidity of foundation.
2. Economy in the use of materials.
3. Weight and character of material suitable for backfilling over aqueduct.
4. Character and quality of the soil as to chemical characteristics, and amount of moisture.
5. Depth of penetration of frost in different soils.
6. Elevation of permanent ground water level relative to invert of aqueduct, as affecting the tendency to float and to change the form of the section after construction.
7. Practicable construction methods to secure the expedition of the work.
8. Range of temperature of the water.
9. Character of soil as to relative amounts of clay, silica and organic matter in its composition.

The problems of arch design and invert design were influenced by quite different factors. Any arch design, to be strong enough to resist cracking, must be provided with practically unyielding foundations; in the larger Winnipeg arches a deflection of the invert by so little as 1-40 inch would crack it, and then the spreading of the feet of the arch following the further flattening of the invert would crack the arch along the center of the roof. Making the arches twice or perhaps even three times the thickness required for rigid foundations would not have prevented arch cracks under uneven settlement of the footing of the arch. The principle was therefore adopted to design the arches on the assumption of rigid foundations, and secure these, or as near these as practicable under local conditions.

The form of the arch and thickness of the arch ring were based, in general, on a backfill load of 4 feet deep over the top of the arch weighing 100 pounds per cubic foot, the width of the backfill, on top, being in all cases equal to the width of the aqueduct inside, with a minimum of 8 feet and side slopes for embankments of 1 vertical on 1¾ horizontal. The concrete was assumed to weigh 140 pounds per cubic foot. The stress diagrams for the arches were determined from the above loads, the earth pressure directions varying gradually from vertical, at the top in the center, to a slope towards the aqueduct of 20 degrees from the vertical at the bottom of the aqueduct; the concrete weights acting vertically downward; the water pressure within the aqueduct, for various depths of flow, acting radially outward, normal to the aqueduct faces; and ground water pressures, when expected, acting normal to the outside surface and inward toward the aqueduct.

The limiting lines for the inside and outside faces of the arches were determined from these stress lines by so adjusting these that for all conditions of loading the resultant lines of force would fall within the middle third of the section. The satisfying of this condition provides that there can be no tension in any portion of the concrete section, and therefore no tendency toward cracking of the arch.

The stresses in the "B" section of the aqueduct, which was used for a little over 6¼ miles are shown in Figure 1.

Only under two conditions did there appear to be a necessity for reinforcing the arch, and these were under road and railroad crossings, and where the aqueduct crosses the Brokenhead slough, where the back-fill material was practically all vegetable matter weighing only about

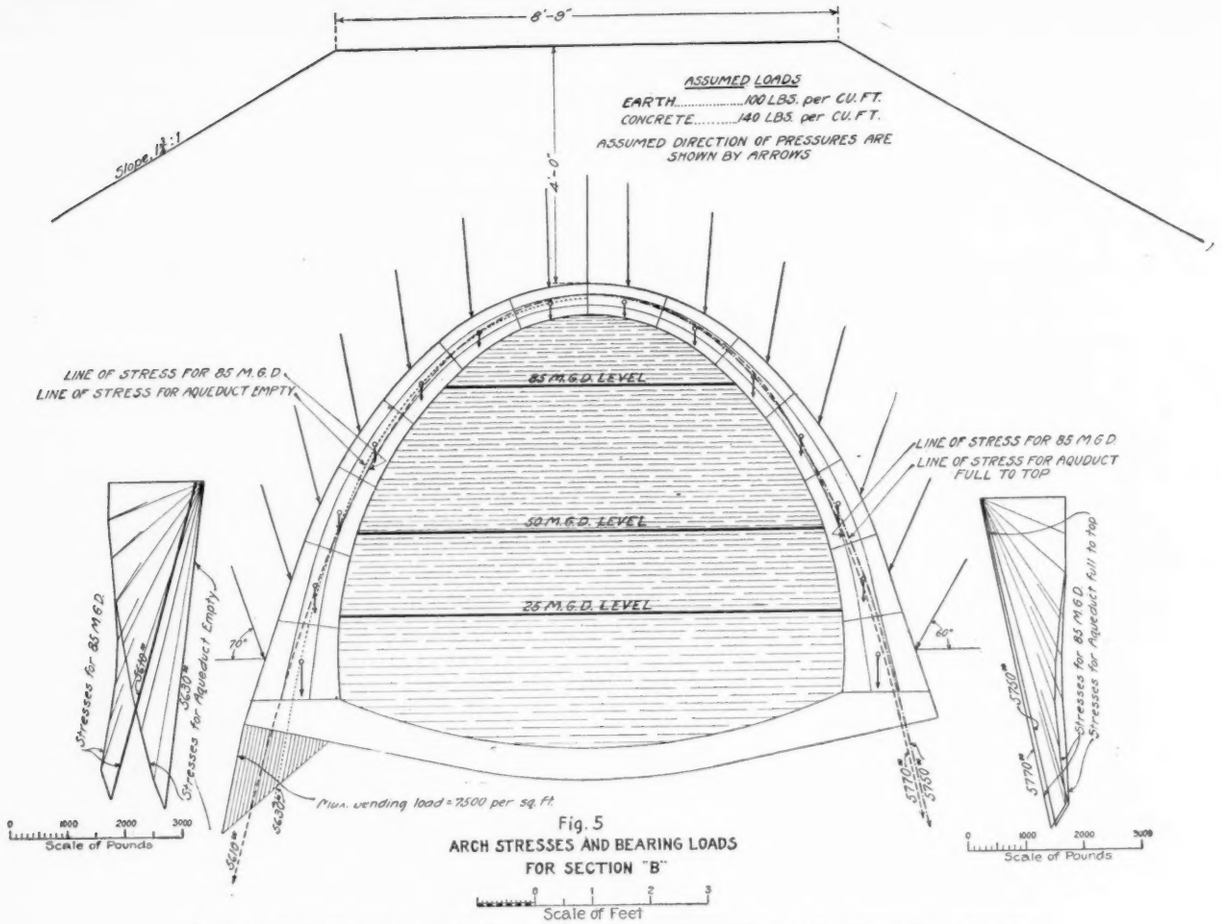


Fig. 5
ARCH STRESSES AND BEARING LOADS
FOR SECTION "B"

FIG. 1—B SECTION OF AQUEDUCT. ARCH STRESSES AND BEARING LOADS

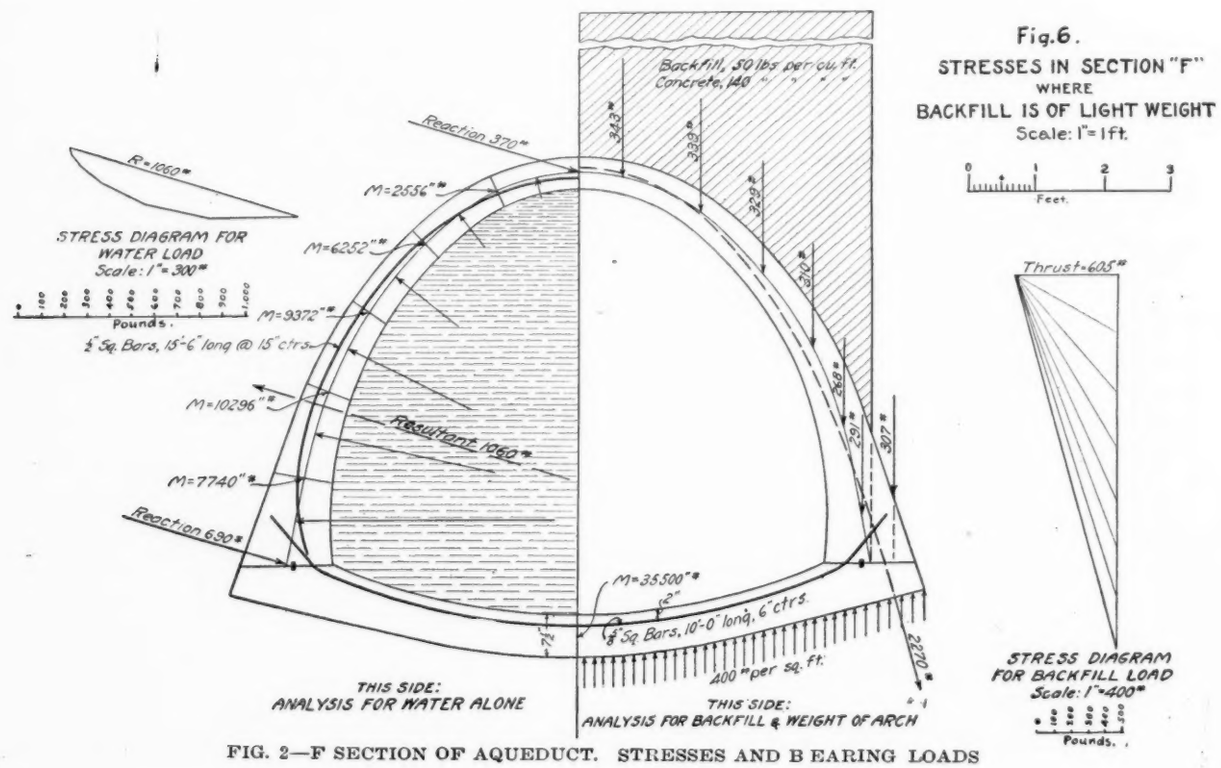


Fig. 6.
STRESSES IN SECTION "F"
WHERE
BACKFILL IS OF LIGHT WEIGHT
Scale: 1"=1ft.
0 1 2 3
Feet.

FIG. 2—F SECTION OF AQUEDUCT. STRESSES AND B EARING LOADS

50 pounds per cubic foot. The internal outward pressure of the water flowing through the aqueduct here would tend to produce deformation of the structure, or lifting of the arch off the invert; and reinforcing steel was necessary to tie the structure together as a unit and counteract the bending tendency in the sides of the arch. The stresses in this section are shown in Figure 2.

ACTION OF FROST

As to the possible depth of penetration of the frost in aqueduct embankments, or its action or effect, some rather surprising facts were noted during the winter of 1915-1916 in investigating this matter. In the prairie section, for instance, it was found in one place that where frost had gone down 4 feet on the prairie, it was of less depth on the top and side slopes of the embankment over the aqueduct, which was in a rather shallow cut at this point. On digging a trench crosswise of the aqueduct to examine the condition of the embankment, it was found that the linear expansion parallel to the surface of the side slopes and top of the embankment, due to the freezing of the clay soil, had caused the frozen back-fill to raise up, where passing over the arch, forming a cavity between the arch and the embankment (supposed to be resting on it). This cavity was about five feet wide across the aqueduct, tapering from nothing at the sides to over 6 inches high in the center over the arch. In another place where the aqueduct is in a 7-foot cut, the frost penetrated the prairie about 4 feet, the bottom of the frozen ground extending horizontally through the backfill and against the arch, where it had frozen fast to the concrete and produced strains, the effects of which were shown in the cracking of the arch on both sides and its being lifted vertically about ¼ inch. After frost left the ground the arch settled down again in place to its original position. The invert did not crack, the cracks in the side walls were parallel to and 3½ feet above the invert. These effects were produced, however, before the backfill had been entirely completed and while the aqueduct was empty, during a very cold winter. Practically no expense was necessitated for repairs.

TEMPERATURE IN AQUEDUCT

Taken as a whole, the depth of backfill chosen was sufficient but not too much. Continuous observations throughout the whole length of backfilled aqueduct during the cold winter referred to showed that the temperature of the air within the aqueduct, except in the immediate neighborhood of open manholes or connections, remained around 35 degrees to 37 degrees Fahrenheit until the advent of warm weather.

In most places frost did not petetrate to the arch until Spring, and then showed in a band of hoar frost of varying widths in different places, sometimes being only a foot or so and sometimes extending down to within a foot or two of the bottom of the arch on each side. The muskeg covering was quite efficient as frost protection, but required a covering of earth or gravel as protection against fire. Frost penetrated most deeply and most quickly through moist, densely consolidated clay; less deeply and more slowly through sand and gravel; and least extensively and most slowly in the muskeg covering after it had been in place for some time and had a chance to dry out somewhat.

ADEQUACY OF ARCH DESIGNS

The arches designed on the above assumptions have stood without defect or showing any sign of weakness. They are thin and were made so deliberately and after much thought and study. This was recognized in the estimates submitted in the report of Hering, Stearns and Fuertes, and was discussed extensively during the preparation of that report, the conclusion being reached that every justifiable economy should be practised in the building of these works. The difficulties of putting an aqueduct through 100 miles of wild country, largely swampy, with uncertain and unknown conditions as to foundations, were fully realized; and, on account of the great cost of the works for a young community grown and growing so rapidly and needing water to maintain its very existence, to have stood upon the principle of "no risk" in the designs would have rendered the project totally impossible, on account of the great cost involved.

It was known that settlement might be expected but that, the aqueduct being one through which the water would flow as in an open ditch without exerting pressure, there would be no difficulty and but little expense involved in making repairs. For practically the whole length, the bottom of the cut-and-cover aqueduct has been placed at such an elevation that the surface of the flowing water in the aqueduct may be kept lower than the natural ground surface until the consumption of water by the District shall have increased to or exceed about 50 million gallons per day, and an open ditch would have served the purpose of carrying the water from river crossing to river crossing all the way from Indian Bay to Mile 23. In fact, a scheme like this was suggested in 1883 by Dr. Agnew, who proposed conveying the water to Birds Hill and distributing it from there.

The cut-and-cover of the aqueduct, therefore, is to be considered in the light of a lining for a ditch, given an arched section in order to permit covering the ditch for the protection of the water from vegetation and dirt and from cold, and to permit making the ditch smaller by reason of the smooth walls and bottom provided by the concrete surfaces, on which the water would run faster than it would in a natural ditch through the open country.

PRESSURE SECTIONS

Only at the river and valley crossings is this aqueduct in any respect like a pipe line, and at all such places it has been given a circular form and contains enough steel bands to take all the bursting strains due to the water pressure and all the distortion strains due to the earth backfill, without straining the steel to more than 10,000 pounds per square inch in tension or the concrete to more than 500 pounds per square inch in compression. These low limits were fixed after much study of the extension of the steel under tension and the amount of extension the

concrete, as made, would stand without showing hair-cracks. While it was not a matter of serious consequence whether cracks appear in the cut-and-cover sections of this aqueduct, as these could be repaired easily, it would have been fatal to allow cracking of the concrete containing steel reinforcement, as the steel would than be exposed to the action of the water and would in time be attacked. As rusted steel occupies more space than clean, dry steel, the exposure of the steel would result in the scaling of the concrete away from the steel and the ultimate rupture and destruction of that portion of the aqueduct. The stresses in both steel and concrete were limited, therefore, to amounts which experience gained by experimentally bursting reinforced concrete pipe lines by internal pressure showed to be well on the safe side of the danger limits, and, so far as known to date, these assumptions have proved sound in practice.

(To Be Continued)

Mexican Troubles and American Irrigation

Although a considerable part of the boundary between Mexico and the United States is a natural one—the Rio Grande river, the western half of the boundary is not so distinctly defined by any natural features. Even the stream which forms the extreme western boundary is merely a shallow creek bed which contains no water a large part of the year. Settlements along the boundary line, some of them straddling it, are accustomed to the inconveniences attending the battles and promiscuous shooting which occur just across the border, but few residents of this country except those immediately concerned realize some of the other inconveniences brought upon this country by the conflicts of authority or lack of authority existing in that unfortunate country.

One of the unspectacular effects to which we refer is in connection with irrigation in California just above the border. The Imperial Valley irrigation system is supplied by canals, the headgates of which are in Mexican territory, and many miles of canals cross that territory before reaching the boundary line. Military operations in this part of lower California, which is apparently to suffer in the immediate future from a conflict of authority between the governor and president, might easily destroy the headworks, in which case the farmers of the Imperial Valley would be deprived of irrigation water, which would mean the inevitable destruction of their crops. The United States government cannot maintain an armed force in Mexico to protect these headworks, and the contending armies, to which military considerations overshadow everything else, might easily complete the damage before diplomatic action through the Mexican governent could secure the needed protection.

Big Iowa Drainage Project

A drainage ditch 23 miles long, practically across Johnson county, Iowa, at a estimated cost of $270,000, is being considered by the Board of Supervisors of that county.

Immigration Notes

Number of arrivals increasing weekly. From some countries they are limited only by the transportation facilities.

2,000,000 Italian Immigrants Waiting

Representatives of twenty-one steamship companies have made statements to immigration commissioner F. A. Wallis indicating that for the next five years, the rate of immigration to this port will be limited only by the accommodations of passenger steamships.

The representative of one Italian line said that there have now been made in Italy alone, 2,000,000 applications for passports to America. An agent of the Hebrew Sheltering Society says that arrangements have been made to receive 1,000 Jewish immigrants a week for the next 52 weeks. Another steamship agent said that applications for passage already received are sufficient to fill up the booking completely for ten years.

It is predicted that the arrivals will soon reach 25,000 per week. This rate, if continuously maintained, would amount to more than one and a quarter millions yearly, which is probably in excess of the transportation now available.

The steamer Dante Alighieri, from Naples and Genoa, landed 2,000 passengers at the port of New York on August 22, all of whom were however detained for observation at Hoffman Island on account of a case of smallpox that had developed on board, although the passengers had been vaccinated before leaving Italy Aug. 8.

During the week ending August 21, there were reported 10,914 arrivals from Europe at the port of New York, but as the number included 1,800 cabin passengers, it leaves only 9,114 that are presumably in the working class, a number which, to give the real accession to the supply of workingmen, must be still farther reduced by the subtraction of about 1,000 Irish girls who form most of the list on the Celtic, besides the considerable portion of women and children in the other vessels.

The already large and often undesirable foreign Jewish element in this country is likely to be more and more rapidly increased by the flood of refugees that are seeking to enter America from the European war districts. They are reported to be coming from Poland to Danzig where they hope to embark for the United States at the rate of 250 families or a thousand persons daily. Other large groups of Jews have been reported frequently as arriving or on their way, and as they manifest a strong disposition

to gather in large cities and do no generally afford efficient recruits to mechanical and construction operations or to agricultural pursuits, it would be well to have their arrival as strictly supervised as is that of the Asiatics on the western coast.

It is reported that the Brazilian government has just transported the first contingent of a lot of 2,500 German settlers, accompanied by professional men with credentials from the interial German Emigration Bureau, who are the first of a series of contingents of the Teutonic invasion of Brazil.

During the latter part of August, it was officially reported from Washington that the number of immigrants daily landing at Ellis Island had increased to 5,000 and that during the year ending June 30, 800,000 immigrants arrived in the United States as compared with 141,132 during the previous year. Although there is still great difficulty in securing transportation, which is inadequate, and trouble in leaving Central Europe, the number arriving is constantly increasing and all steamship accommodations for the next year have already been engaged.

According to statements from Winnipeg, Canada, 3,000,000 acres of land in western Canada have been purchased since the beginning of this year by about 100,000 American farmers, most of whom expect to settle upon it next spring. These purchasers brought into Canada more than $5,250,000 cash and other property valued at more than $1,700,000 and requiring nearly 400 railroad cars for its transportation.

Foreign Restriction of Immigration

In a bulletin issued by the Inter-Racial Council it is stated that: "The time has passed when the American employer could count upon an unlimited supply of labor from abroad. Emigration from the countries of Europe will be strictly regulated by the governments in the near future, and is already being directed in some of the Old World nations, which have begun to realize the value of their workers.

"This is the case in Italy, for instance, which has supplied us with such vast numbers of unskilled and semi-skilled laborers. The French Government has offered Italy six tons of coal per month for each Italian miner induced to go to France, and The Commissioner of Emigration of Italy is advising his people to emigrate to France. It is asserted that opportunities are better there than in America, both for steady work and high wages.

"Other countries are making efforts to keep their citizens at home. Greece is offering inducements of farms to the people, having passed an act by which large land owners may retain only one-third of their estates, while surrendering two-thirds to the peasants. If this offer should not be sufficiently persuasive, emigration from Greece may be prohibited at any time by law. Conditions in that country are being studied at present to determine what action may be necessary to prevent an undue exodus of the population. The extension of Greek territory is a powerful reason for keeping these people in their own country.

"Similar conditions are found in Finland, where areas have been set aside for settlement, and farm implements and supplies are offered to small cultivators on liberal terms.

"These instances show the attitude of foreign governments toward their nationals. Instead of permitting their men and women to leave at will and select their own destinations, as in our port, emigration will be curtailed, by many governments. . . .

"Some of the foreign nations are planning to do the things which America should have done long ago; to protect immigrants from fraud, to establish official information bureaus, to take care of their savings through branch banks and generally to look after their welfare.

"International agreements are being made between Old World countries regarding immigration. Diplomats of Hungary, Poland, Greece, Italy, France, Lithuania, Spain, Portugal and the Balkan countries have taken the lead in such conferences, but the United States, which has so much at stake in the matter, has shown indifference.

"We should not be deceived by the temporary increase in immigration. The figures that indicate a large number of arrivals at Ellis Island fail to show the fact that the proportion of women, children, professional and clerical workers is so great as to afford little relief to our labor shortage. Of the manual laborers coming in, a large percentage are men who went abroad to fight and are now returning to their old jobs. Of the new workers, to do the essential work of America, there is an exceedingly small percentage, while recent correspondence from all parts of the United States indicates serious shortage of labor in almost every section.

"The course of action for the employer is, therefore, first, to conserve labor as carefully as he conserves his raw material; second, to regard immigration problems with the same interest that he gives to international commerce, realizing that America is no longer isolated and that what happens in the Old World today, will be reflected in his own business tomorrow.

An international conference on immigration is planned for 1921, in which the United States should play a leading part. Business men who are interested may obtain further details through The Inter-racial Council, Woolworth Building, New York."

Municipal Railway Operation Voted Down

At a political primary on August 10 the citizens of Toledo, Ohio, voted down two proposals concerning the municipal operation of street cars by a majority of about three to two; these propositions involving the issuing of bonds for $3,000,000 in one case and $4,000,000 in another. At

the same time the people voted in favor of an $11,000,000 bond issue for the city's schools. This was a decided set-back for those who had been advocating government ownership of the railways. It is reported that an ordinance will probably be submitted to the people providing for a service-at-cost operation of the railways.

San Francisco's Municipal Railways

News recently received from San Francisco states that the municipal railroad system is running behind at the rate of $130,000 to $140,000 a year on the car service payroll alone, with no additions to the sinking fund to take care of deterioration and general depreciation. The supervisors are said to be meeting the monthly deficits by drawing upon the present depreciation fund. It must be only a matter of time when this will have vanished, and the road will then have to come back on the taxpayers or else considerably increase the rates of fare in order not only to meet running expenses but to rehabilitate the depreciation fund.

The suggestion that the deficit could be greatly reduced if not wiped out by running one-man cars will not be adopted, it is believed, because the supervisors will not risk their political future by discharging a large percentage of the present employees. As to raising fares, it is urged that this would decrease the income rather than increase it, because the private company with which the municipal system has to compete would then attract a large part of the traffic by their lower fares.

The above figures are published with supporting details from the San Francisco Chronicle. On the other hand, however, the Board of Public Works states that the municipal railway is not running behind by any such amount but that the net deficit for the twelve months ending June 30, 1920, was approximately $16,000, based on a wage scale of $5 for an eight-hour day for platform men. According to the figures issued by the board, the net receipts for that year totalled $2,729,016 and the total expenses were $2,745,074. These expenditures include operating expenses of $1,996,389, bond interest $233,503, depreciation and accident insurance reserve $496,806, and other expenses of $18,376. Eighteen per cent of the gross passenger revenue is set aside for depreciation, redemption of bonds, renewals, accidents, insurance, reserve, etc., and also an amount sufficient for the protection of its employees.

Since December 28, 1912, the gross receipts have totalled $13,733,276 and the cost of operation has been $8,639,834, leaving as the excess of revenue over operating costs $5,093,442. Out of this excess it has paid interest on bonds and redeemed $800,000 worth of bonds and has built extensions costing nearly one and one-half million dollars and has to its credit in the treasury $1,180,187.

During the latest fiscal year it carried 66,169,246 passengers and operated 7,419,272 car-miles. There were filed 2,019 accidents, seven of which were fatal (only one of these to passengers), and 657 personal injuries. Of the 2,019 accidents, 1,231 were collisions with autos and wagons, 157 due to boarding a moving car, 126 to leaving a moving car, 112 to car collisions, and 393 miscellaneous. The total amount paid for accident claims was $19,017 for personal damages and $1,668 property damages, with $12,145 as cost of adjusting these claims.

California's Irrigation Act Illegal

A state irrigation act was passed in California in 1915 and amended in 1919 which provided for the formation of irrigation districts. Under this act five districts have been organized and nine applications are pending before the State Irrigation Board. The Supreme Court a few days ago declared that the act was illegal on account of its "lack of uniformity of operation," the act being so worded that it would not apply to any county which had adopted a county charter and there being only two such counties in the state.

This leaves the five irrigation districts as invalid and automatically discharges the members of the State Irrigation Board. According to a member of a California bond house, the decision in no way affects the outstanding bonds amounting to $25,000,000, since these were issued under a previous act and none have been issued under the act of 1915.

Enormous Colorado River Dam Proposed

Plans now under discussion for the irrigation of Imperial Valley, Calif., are being investigated with appropriations of more than $60,000 and borings are being made to explore the foundations for the proposed Boulder Canyon dam of a possible height of 600 feet and a storage capacity of 25,000,000 acre-feet to regulate the flood flow of the Colorado river and supply irrigation to all arid lands both in Mexico and the United States. The construction of the dam would also prevent flood damages and provide for the generation and distribution of an enormous amount of hydro-electric power.

Corrected Weight of Structural Steel

The association of American Steel Manufacturers announces a revision of the tables of standard weights of minimum sizes of I-beams and channels which will correct the slight differences for many years existing between the published weight and the dimensions of the standard cross-sections. There is no change in the profiles and properties of sections having minimum web thickness, and no change in the weights and properties of intermediate and maximum sections. The minimum weights are all slightly increased by amounts varying from 0.2 pound to 0.9 pound per foot for I-beams from 3 inches to 24 inches in depth, and varying from 0.1 pound to 0.9 pound per foot for channels from 3 inches to 15 inches in depth.

Recent Legal Decisions

APPORTIONMENT OF COST OF PAVING STREET

Texas Rev. St. 1911, art. 1009, authorizes payment for street paving wholly by the city or party by the abutting owners, but provides that the owners cannot be assessed for more than three-fourths of the cost. In an action by a paving contractor upon special assessment street paving certificates, the Texas Court of Civil Appeals holds, Sullivan v. Roach-Manigan Paving Co., 220 S. W. 44, that the three-fourths of the cost of paving a street which can be assessed against property owners under this statute is three-fourths of the entire cost of the paving, although a street car company was compelled by its franchise to pave part of the street. There was no doubt of the city's power to contract for the pavement of the entire street, even though it could have required the car company to pave part of it. (McNeill v. South Pasadena, 166 Cal. 143, 135 Pac. 32, 48 L. R. A. (U S.) 138.) The apportionment made in this case resulted to the advantage of the public and the property owners, as the company was required to pay for the portions described in the statute instead of a smaller area described in the franchise ordinance.

ROAD COMMISSIONERS, AUTHORIZED TO PURCHASE IMPLEMENTS, CAN LEASE THEM

Arkansas Acts 1915, No. 383, section 31, provides that a board of road improvement commissioners created under the statute may "purchase material and implements necessary to carry on the work of the improvement." The Arkansas Supreme Court holds, Galloway v. Road Improvement Dists., 220 S. W. 450, that the power to purchase includes the power to lease road building machinery. The word "purchase" is essentially applicable to the procurement of material, for that, when used, becomes a part of the roadbed; but implements and other equipment, which are not exhausted in the work of construction may be procured in other ways than by purchase. The authority to purchase being the greater of the powers to be exercised, necessarily includes the lesser power to lease or to accept as a donation.

EXTRA WORK ON ROAD CONSTRUCTION CONTRACT—UNAVOIDABLE DELAY

A road construction contract was let in accordance with a bid to furnish all material, tools and labor for a stated amount. The Arkansas Supreme Court holds, Osborne v. Luter, 220 S. W. 481, that on completion of the contract the contractor was entitled to the specified amount and nothing more, regardless of whether the work was under or over the engineer's original estimate, although the proposal to bidders provided for payment for actual work performed. The contract did not prevent the highway commissioners from having extra work done without materially altering the general plan of the improvement, and for performing such extra work the contractor was entitled to compensation. Under Arkansas Acts 1915, No. 338,016, road commissioners are not required, in order to have such extra work done by the contractor, to revise the plans and give the landowners notice thereof. This section applies only when some material alteration of plans or specifications is proposed. A road contractor cannot recover for extras where he does not show that such work is not covered by the plans and specifications upon which his bid was proposed.

The contract provided that the work should be done within 150 working days, and that liquidated damages at $10 per day should be paid for all time in excess thereof consumed by the contractor. Delay resulted from causes beyond the contractor's control, and not within the contemplation of the parties, and 390 days were consumed in the construction. Damages, therefore, could not be charged to the contractor.

RIGHT OF ACTION OF LABORERS AND MATERIALMEN ON GOVERNMENT CONTRACTOR'S BOND—TIME LIMIT

The federal district court for the Western District of Kentucky held Belknap Hardware & Mfg. Co. v. Ohio River Contract Co., 264 Fed. 676, that the right given those who have furnished materials or labor to a government contractor to sue in the name of the United States on the contractor's bond, under act of Congress Feb. 24, 1905, is to be enforced by an action at law on the bond, not by a suit in equity. Under that statute an action by laborers and materialmen on the bond cannot be begun until the expiration of the six months after the completion of the work allowed for action by the United States on the bond for its own benefit, and must be brought within one year of such completion. This statute entirely supersedes that of Aug. 13, 1894, which did not fix any limitation of time for such a suit. After the time for suit has expired, there is no equity against the sureties on the bond in favor of laborers and materialmen which entitle the latter to preference in payment from a fund in the hands of the receiver of the contractor, as against creditors of the contractor who were also sureties on the bond, especially where the laborers and materialmen, by suing on the bond within the time required, could have collected their claims in full from a fund then in the hands of the receiver, so that the sureties could have been relieved of all liability.

CONTRACTOR SUING FOR SUBSTANIAL PERFORMANCE MUST SHOW COST OF WORK NOT DONE

Where an excavation contractor seeks to recover for substantial performance he must first show the cost of the work not performed.— Conforti v. Singhi, New York Appellate Division, 182 N. Y. Supp. 899.

NEWS OF THE SOCIETIES

September 13-16—PACIFIC COAST ASSOCIATION OF FIRE CHIEFS. Annual convention Los Angeles, Cal. Secretary, H. W. Bringhurst, Seattle, Wash.

September 13-17—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting San Francisco, Cal. Secretary, A. W. Hedrich, 169 Massachusetts Ave., Boston, Mass.

Sept. 16-18.—ENGINEERING INSTITUTE OF CANADA. Meeting to be held at Niagara Falls, Ontario.

Sept. 20-23 — SOUTHWESTERN WATER WORKS ASSOCIATION, Annual convention, St. Charles Hotel, New Orleans, La. Secretary, E. L. Fulkerson, Waco, Texas.

Sept. 27-Oct. 21—NATIONAL SAFETY COUNCIL. Ninth annual safety congress at Milwaukee. W. H. Frater, treasurer and business manager, 168 North Michigan avenue, Chicago.

Oct. 12-14—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. St. Louis, 401 Lincoln Avenue, Valparaiso, Ind.

October 13-15—AMERICAN CIVIC ASSOCIATION. Annual convention Amherst, Mass. Secretary, E. F. Marshall, Union Trust Bldg., Washington, D. C.

October 16-19—AMERICAN COUNTRY LIFE ASSOCIATION. Annual conference Springfield, Mass. President, Kenyon L. Butterfield, Amherst, Mass.

Oct. 19-22—INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. 25th annual convention, New Orleans, La. Secretary, C. R. George, Houston, Texas.

Dec. 7-10 — AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting. New York Secretary, 29 W. 39th St., New York City.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

AMERICAN SOCIETY OF CIVIL ENGINEERS

At the annual convention of the American Society of Civil Engineers held in Portland, Oregon, August 10-12, the annual address of Pres. Arthur C. Davis, vigorously discussed "whether or not the society is to take its proper place among human activities or gradually decay and become an obstruction to progress, pretending to fill a niche which it does not fill, and wasting the prestige and history of this glorious society."

He severely criticised the minority in the American Society of Civil Engineers that was charged with opposing the co-ordination and co-operation of the founder societies. He did not consider the Engineering Council to be a satisfactory organization for producing practical results and recommended the substitution for it of a league of engineering societies. He was in favor of license laws of the centralization of federal engineering activities in a single department.

In the proceedings of the convention much prominence was given to 14 proposed constitutional amendments of which finally four were ordered to be sent to letter ballot as originally proposed, four were slightly revised and ordered to letter ballot, and six were referred to a committee of the Board of Direction for report at the annual meeting next January.

In accordance with the recent custom, the meetings of the convention were devoted to business purposes, and papers and lectures, which in former years had been presented, were not on this program. Time not devoted to business meetings was available for a variety of social pleasures, including a special automobile trip of about 400 members up the Columbia river, a smoker including members of the Oregon Technical Council and of the American Association of Engineers, and a harbor trip visiting the municipal terminals, the Standifer steel shipyard at Vancouver, Wash., and the Interstate bridge.

AMERICAN ASSOCIATION OF ENGINEERS

The Twin City Chapter has arranged with the general extension division of the University of Minnesota to form evening classes in various subjects. The classes will be instructed by members of the faculty of the university and by the leaders in professional practice outside the university. Only twelve students in each class are required to inaugurate the work in that subject. Classes will be held at the university or at other locations to be selected later. Courses are offered in the following technical subjects: Architectural history, architectural design, freehand drawing, map drawing, surveying, railroad engineering, stuctural design, reinforced concrete, elementary electricity, direct and alternating current machinery, power plant design, shop mathematics, applied mechanics, heating and ventilating, water power, municipal engineering and highway engineering.

In addition to the technical subjects offered the following business and arts courses are also available: Art appreciation, English, modern language, history, political science, accounting, business law, banking practice, corporation finance, cost accounting, transportation, railway traffic and rates, business English and public speaking. Credit for the arrangements for the courses in the Twin Cities is due to Professor Frederic Bass, head of the department of Civil engineering in the University of Minnesota.

The Chicago Chapter, which held some very successful classes in public speaking and other subjects last year, announces plans for classes this year in public speaking, business organization and administration, scientific methods of testing and handling labor, engineering accountancy, and banking and finance.

The city and county of Honolulu is in urgent need of a comprehensive plan for an adequate supply of water as well as a complete sewer system. The mayor and the board of supervisors have gone on record as favoring a comprehensive program to be financed by a bond issue. The Honolulu Chapter of A. A. E. is endeavoring to bring about the appointment of a commission of three engineers to act in advisory and consulting capacity in cooperation with the city and county water and sewer department. The appointment of this commission has brought to the attention of the Chamber of Commerce, and recommendations have been made by James T. Taylor, second vice-president of the chapter and a consulting engineer of Honolulu, regarding the personnel of the commission and remuneration the members of it should receive. The president of the chapter is John H. Wilson, mayor of the city and county of Honolulu. The first vice-president is Lyman H. Bigelow, superintendent of public works and chairman of the Board of Harbor Commissioners of the Territory of Hawaii.

Additional appointments to the national committee on employment include A. A. Potter, dean of engineering in Purdue University; A. E. Harvey, chief engineer Kansas City Railways; H. W. McChesney, chief draftsman, C. M. & St. P. Ry, Chicago; C. W. Koiner, consulting engineer, Pasadena, California; Frederick Whitesell, mechanical engineer, Fairbanks-Morse Company, Chicago; John F. Johnson, service manager, Union Construction Company, Oakland, California; Wharton Clay, commissioner, Associated Metal Lath Manufacturer. Chicago. George C. D. Lonth, consulting engineer of Chicago Board of Local Improvements, is chairman of the committee.

Application of the Transportation Act of 1920 will be discussed by railroad members of the American Association of Engineers at meetings to be held at Parsons, Kansas, on September 1, Kansas City on September 2, Omaha on September 3 and Lincoln, Nebraska, on September 4. Assistant Secretary Brandt, who is in charge of the A. A. E. Railroad Department, will speak at each meeting. An effort will be made to determine methods of creating a better spirit of cooperation between the management and railroad sections, particularly in operating and economic problems. The association now has about sixty railroad sections.

The Illinois assembly of the American Association of Engineers has been organized with ten member chapters, and the Washington State assembly of A. A. E. will be permanetly organized at a state convention to be held at Everett, Washington, on August 24th.

The Nebraska Assembly of the American Association of Engineers, embracing the chapters of A. A. E. in Nebraska, announces the appointment of Ernest E. Trimble of Omaha as a full-time secretary, with headquarters in Omaha.

C. D. Lucas, resident engineer for the Cuyamol Fruit Company of Puerto Cortez of Honduras, is organizing a chapter of the association in Puerto Cortez.

The Washington assembly of the American Association of Engineers was permanently organized on August

21 with G. M. Osgood, port engineer of the Port of Tacoma as president and Courtland Penny as secretary. The members of the executive board are Messrs. Sharp of Spokane, McMorris of Seattle, Tegitmeier of Everett. Presidents of all chapters in Washington are to be ex-officio members of the assembly executive board. A state license law was considered at the first meeting and decision made to have it introduced into the next legislature.

A feature of the 1920 membership campaign to be held by the American Association of Engineers from September 15 to October 30, is the agreement of the Chicago and New York Chapters to compete during the campaign for a silver cup. The Chicago Chapter, which now has about 1,500 members issued a challenge to the New York Chapter, which has about 1,000 members. The latter chapter has accepted the challenge and issued a statement declaring that it will not only obtain members to the association during the campaign, but will bring its membership to a total higher than that of the Chicago Chapter.

NATIONAL CONSTRUCTION CONGRESS

At a meeting held at Atlantic City, August 6-7, representatives of the Associated General Contractors of America, the American Institute of Architects, Engineering Council, the National Building Trades Employers' Association, and the American Federation of Labor, decided that a building and construction congress should be permanently established, and appointed a committee to meet in Chicago, September 27, to plan for calling the congress.

PORTLAND CEMENT ENGINEERS

In Seattle, Aug. 16 and 18, a meeting was held of western district engineers belonging to the Portland Cement Association. The construction of concrete highways was especially discussed and a large amount of highway under construction was visited and aggregate plants were inspected.

AMERICAN CONCRETE INSTITUTE

At the sectional meeting held in New York, July 16, W. A. Slater of the U. S. Bureau of Standards, described investigations of shear strength of concrete that had been made by the Emergency Fleet Corporation.

MASTER BUILDERS ASSOCIATION OF WISCONSIN

A branch of this association to be known as the Marshfield Builders and Traders Exchange has just been formed at Marshfield, Wisc., with 25 charter members, R. L. Peterson, president, and Gus Krasin, secretary.

UNION OF CANADIAN MUNICIPALITIES

The 1920 convention of the union of Canadian municipalities was held at the Council Chambers, City Hall, Quebec, July 27. Among the principal papers presented were: Our Municipalities and Labor, by F. A. Acland, (Federal), Deputy Minister of Labor. Latest Ideas Respecting Public Health, by Hon. W. F. Roberts, M.D., Minster of Public Health, New Brunswick. The Municipalization of Public Utilities, by L. A. Herdt, Chairman of Montreal Tramways Commission. The Administration of the City of Quebec, by H. J. J. B. Chouinard, City Clerk of Quebec. Commission Government in Small Towns, by F. W. Gailbaith, Ex-Mayor of Red Deer, Alta. The Municipalization of Housing, by Rosaire Prieur, Mayor of Pointe-auz-Trembles, Secretary. Union of Quebec Municipalities. Recent Progress of Western Municipalities, by J. D. Saunders, City Clerk of Cambrose, Alta., Sec. Union of Alberta.

NATIONAL SAFETY COUNCIL

The 9th annual safety congress of the National Safety Council will be held at Milwaukee, Sept. 27-Oct. 1. Official representatives of all cities with a population of 25,000 or more have been invited, and the acceptances already received indicate an attendance representing more than 100 municipalities.

Exhibits showing every type of traffic signalling device on the market, automobile safetv devices and other safety apparatus will be shown in machinery hall of the auditorium. Among the principal papers announced on the program are: "The Traffic Officer and His Relation to the Public," J W. Inches, M. D., Commissioner of Police, Detroit; "Law Enforcement and Its Application," Judge George E. Mix, Municipal Court, St. Louis.

Report of Committee on Traffic Hazards, Louis J. Smyth, director, Kansas City Division, National Safety Council, Kansas City, Mo.; Report of Committee on Public Utilities, R. E. McDougall, Rochester Railway Company, Rochester, N. Y.

"Hazards in Line Construction-Handling Poles, Erecting Poles, and Reconstruction of Old and Antiquated Lines," F. W. Fisher, Rochester Railway and Light Company, Rochester, N. Y.; "Accident Hazards in Laying Conduit Underground," H. W. Lueck, Commonwealth Edison Company, Chicago.; "Accident Hazards in Laying Gas Mains," R. S. Carter, Supt, Malden and Melrose Gas Light Company, Malden, Mass.; "Utility Accidents to the Public Prevented Through School Safety Education," Dr. E. Geo. Payne, Principal, Harris Teachers' College, St. Louis.; "Medical Service in Public Utilities," Dr. C. H. Lemon, Chief Surgeon, The Milwaukee Electric Railway and Light Company, Milwaukee, Wis.; "Hazards in Building Additions to Power Plants—Protecting Operators and Equipment," W. H. Mulligan, Hydro-Electro Power Commission of Ontario, Toronto, Ontario, Canada.

AMERICAN ASSOCIATION OF PORT AUTHORITIES

The annual convention of the American Association of port authorities, Chicago, October 4-6, will discuss ports and harbors of the Middle West, and navigation of the Great Lakes and St. Lawrence river. Papers are expected describing the new harbor work at Vancouver, Portland, Oregon, and Toronto.

PERSONALS

Borck, George, has been appointed road engineer of Ottawa Co., Mich.

Dietzer, H. C., has been appointed state highway engineer of Mississippi.

Earle, D. M., has been appointed city engineer of Worcester, Mass.

Russell, G. A., has been appointed engineer of Geary County, Kans.

Mooney, B. E., has been appointed city engineer of Whitefish, Mont.

Berg, John, has been appointed state engineer of South Dakota.

Keith, Clark, has been made assistant engineer of the Essex Border Utilities Commission, in charge of water supply and sewerage systems of municipalities near the Detroit River.

Chapman, H. D., has been appointed city engineer and superintendent of streets, Richmond, Calif.

Haase, H. J., has been appointed water commissioner, Elmira, N. Y.

Routh, J. W., has opened an office at Rochester, New York, as consulting engineer for municipal work.

Ridley, C. E., city engineer of Port Arthur, Texas, has been appointed to take a course in the New York School of Public Service and will specialize in public administration and city management.

Walton, Col. Edward, has been put in charge of the district office for the Eastern District of the U. S. Construction at Washington, D. C.

Meredith, J. W., has been appointed city engineer of Antioch, Cal.

Easler, R. P., has been appointed manager of the West Coast Dredging Co., with offices in Antioch, Calif.

Johnson, A. M., has been appointed dean of the Engineering School of the University of Maryland and director of engineering research, specializing in highway work in co-operation with the U. S. Bureau of Public Works and the Maryland State Highway Department.

Carson, Gen. J. M., has been made head of the Construction Service of Quartermaster Corps of the U. S. Army. General Carson has done a large amount of construction at West Point and in the Philippines, has been depot quartermaster at New York and in France served in the A. E. F. as deputy chief quartermaster. In 1919, he was made zone supply officer at New York and later depot quartermaster at New York.

Suter, Brig. Gen. Chas. Russel, for many years in charge of Mssissippi River Improvements, in charge of fortifications and harbor work near Boston, on the Board of Engineers reporting on New York Harbor lines, and on the California Debris Commission, died at Brookline, Mass., August 7, at the age of 78 years.

Wright, A. H., a bridge and railroad builder, 89 years old, died at Springfield, Mass., August 16.

Staats, R. P., a building contractor who had executed a large amount of pier and dock work in New York Harbor, died August 8 at Great Barrington, Mass.

Harwood, R. E., civil engineer and road contractor, died at Springfield, Ohio, August 4.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Instal'ations

TARVIA SPRAYING MACHINE

The plank floor of the Back River Bridge, Hingham, Mass., has been protected with a coating of Tarvia applied as shown in the illustration and covered with clean gravel. The method is applicable to any plank bridge with a solid floor, the life of which is greatly prolonged by it. The hard gravel surface forms a durable coating that resists the wear that would otherwise rapidly abrade the wood. Besides this the Tarvia-A has a preservative effect that is a valuable preventive of decay.

The floor planking should be thoroughly fastened to avoid vibration or displacement, and after being well cleaned, should, for an old floor, be primed with a cold application of Tarvia-B at the rate of ¼ gallon per square yard. After this has been absorbed Tarvia-A at a temperature of from 200 degrees to 250 degrees should be evenly distributed over the surface in the proportion of ½ gallon per square yard, preferably applied in two coats with a spraying machine. Clean ½-inch stone chips, slag or gravel being placed over the first coat.

If no spraying machine is available, the Tarvia should be applied with pouring pots, smoothed out with fibre push brooms and covered with clean ¼ to ½ inch gravel or stone chips, at the rate of about 1 cubic yard to 100 square yards of surface. When used on new planks or on creosoted planks, the priming coat is not required. This, and other road surface treatments are described and illustrated in a bulletin on special uses for Tarvia, recently issued by the the Barrett Company.

QUIXTET VOTING PLACES

A bulletin issued by the Blaw-Knox Company describes an all-steel portable building that has been put on the market by them and is especially recommended for polling places and for other purposes where efficient, light, durable and attractive small offices are required.

This building, which is carried in stock in 12x12-foot sizes 8 feet high and in other dimensions, is made with patent pressed galvanized steel wall and roof sheets braced with structural steel members, all of which are standard and interchangeable. They can be stored when not in service. They are wind-proof, rain-proof and fire-proof and of very rigid construction with six windows, and paneled door. The complete building can be quickly and economically erected by two men and can be transported on a wagon or truck. When not in use for other purposes, the buildings are suitable for storing roadbuilding equipment, tools and various supplies or materials, or for office use, being easily shifted from job to job or from place to place on the same job, and quickly assembled and knocked down without injury.

CLAY PRODUCTS

The Clay Products Association has issued for gratuitous distribution to city engineers and other officials, a booklet on sanitation, suggesting ways of promoting sewerage in their own communities. It is designed to create a desire for proper city sewerage by describing bad living conditions in an unsewered town and good living conditions in a fully sewered town. It is proposed to follow it with another dealing specifically with the same subjects.

NEW PAVING ENGINEERING OFFICE

Dow & Smith, Chemical Engineers and Consulting Paving Engineers, announce that they have established a branch office at Columbia, S. C, which is in charge of T. Keith Legare, District Engineer. Mr. Legare was formerly conected with the engineering department of the city of Columbia for eleven years and has had extensive experience with various types of street paving. Service will be rendered in all matters pertaining to paving and road building, analysis of materials, inspection of work, specifications and general consultation.

SPRAYING "TARVIA-A" OVER PLANK FLOOR OF BACK RIVER BRIDGE, HINGHAM, MASS.